ABSTRACTS OF NORTH AMERICAN GEOLOGY

April 1970

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1970

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1970

UNITED STATES DEPARTMENT OF THE INTERIOR

WALTER J. HICKEL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Price 75 cents (single copy). Subscription price: $9.00 a year (12 monthly issues); $2.25 additional for foreign mailing. Use of funds for printing this publication approved by the Director of the Bureau of the Budget (October 10, 1968).

(exp. 12/71)

ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports of memorandums) or of other papers presented orally at meetings.

The Abstracts is an additional reference tool but does not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology are published each year. The Bibliography includes citations and subject index for a calendar year.

The numbers assigned to the abstracts in this publication are for reference in using the index; they are not order numbers. Publications cited here in abstract form are available in most geological libraries or through interlibrary loan.

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A list of journals commonly cited in Abstracts of North American Geology may be obtained by writing to the U.S. Geological Survey, Washington, D. C. 20242. Serial publications cited for the first time are as follows:

Československ, Akad. Věd Geog. Ústav Brno Studia Geog.—Československa Akademie Věd Geograficky Ústav Brno, Studia Geographica. Brno, Czechoslovakia.

Earth Sci. Jour.—Earth Science Journal. The Waikato Geological Society. Hamilton, New Zealand.

Missouri Geol. Survey and Water Resources Educ. Ser.—Missouri Geological Survey and Water Resources Educational Series. Rolla, Mo.

Missouri Geol. Survey and Water Resources Inf. Circ.—Missouri Geological Survey and Water Resources Information Circular. Rolla, Mo.

Panamá Admin. Recursos Minerales Mapa—República de Panamá Administración de Recursos Minerales Mapa. Panamá, Panamá.

The abstracts in this issue were prepared by W. H. Bradley, Calvin S. Bromfield, W. B. Cashion, Georgianna D. Conant, Howard R. Cramer, Katherine A. Friberg, Lowell S. Hilpert, John W. Hosterman, Virginia M. Jussen, E. R. Landis, Elisabeth S. Loud, Mildred C. Mead, Ralph L. Miller, Virginia S. Neuschel, Gregg Vane, Dorothy B. Vitaliano, Walter S. White, and Irving J. Witkind.

ABSTRACTS

Abdel-Hady, M. *See* Matalucci, Rudolph V. 05038

Abercrombie, I. D. *See* deLaeter, J. R. 05464

05235 **Adams, John Emery.** Semi-cyclicity in the Castile evaporite, *in* Cyclic sedimentation in the Permian Basin —Symposium, Midland, Tex., 1967: West Texas Geol. Soc. Pub. 69-56, p. 197-203, illus., 1969.

The late Permian Castile formation of West Texas and southeast New Mexico was deposited in a deep semi-restricted evaporite lagoon. This lagoon was connected with the Permian ocean by a shallow channel through which sea water entered at varying rates. The lagoonal deposits are dominated by alternating laminae of white anhydrite and gray-brown calcite. These cyclically laminated couplets are irregularly interrupted by thick beds of noncyclic halite, unlaminated anhydrite and thinly laminated limestone. The thickness, uniformity and composition of these deposits depended on the rates and uniformity of sea water flow into the lagoon. The stratigraphic irregularities suggest semi-cyclic, rather than truly cyclic, sedimentation. —Author's abstract

05247 **Adolphson, Donald G.; Ellis, Michael J.** Basic hydrogeologic data, Pine Ridge Indian Reservation, South Dakota: South Dakota Geol. Survey Water Resources Rept. 4, 75 p., illus., tables, 1969.

The interpretive report that accompanies these data is U.S. Geol. Survey Hydrol. Inv. Atlas HA-357 (Ellis and Adolphson, in press). The following information is tabulated: records of test holes and wells, of well depths in Bennett County, and of springs; chemical analysis of ground water; summary of streamflow records; and logs of test holes and wells. A selected list of references on geology and water resources of the Pine Ridge area is appended. — MCM

05262 **Ahmad, N.; Jones, Robert L.** Occurrence of aluminous lateritic soils (bauxites) in the Bahamas and Cayman Islands: Econ. Geology, v. 64, no. 7, p. 804-808, illus., tables, 1969.

Aluminous lateritic soil overlies pure limestone. Compared to Jamaican bauxite, it has comparable cation exchange capacities; less gibbsite,bochmite and kaolinite; more chlorite and free silica; less alumina, iron, and phosphorus; more silica and potassium. The deposits are thin and areally limited, and are of doubtful commercial value. They are of interest because they extend the known range of such soils in the western Caribbean, and because they add to the evidence for derivation of Jamaican-type bauxites from limestone residues. — WSW

Ahrens, Thomas J. *See* Thomson, Ker C. 05057

Aki, K. *See* Reasenberg, P. 05181

05195 **Aki, Keiiti; Larner, Kenneth L.** Surface motion of the layered halfspace with an irregular interface due to incident plane Sh waves [abs.]: Earthquake Notes, v. 40, no. 2, p. 3-4, 1969.

05515 **Akili, Waddah.** Mechanical properties of a sand-ice system — Discussion [of paper 6030 by Roy R. Goughnour and O. B. Andersland, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM3, p. 921-923, illus., table, 1969.

In discussing paper 6030 (ibid., v. 94, SM4, 1968), the writer here notes similar behavior of creep of a frozen clay soil from Sault Ste. Marie, Michigan. The results of identification and mineralogical tests are summarized in a table. Creep samples were subjected to a prescribed stress-strain history in the second region of creep, as diagrammed. The reloading portions of the stress-creep curves seem to nearly parallel the unloading parts. A decrease in creep rate with increased strain suggests that the effect of simultaneous hardening and softening processes during creep of this frozen clay tends to increase the sample resistance to deformation. — GDC

05199 **Alcock, E. D.** Identification of seismic wave modes by power spectra analysis [abs.]: Earthquake Notes, v. 40, no. 2, p. 6, 1969.

05067 **Alexander, E. C., Jr.; Srinivasan, B.; Manuel, O. K.** I-Xe dating of silicates from Toluca iron: Earth and Planetary Sci. Letters, v. 6, no. 5, p. 355-358, illus., tables, 1969.

A Reynolds type heating experiment on neutron irradiated silicates from Toluca indicates that the high temperature sites began to retain their radiogenic Xe-129 when the I-129/I-127 ratio was $(1.4 \pm 0.4) \times 10^{-3}$. This ratio suggests that Toluca silicates formed 65^{+6}_{-4} million years before the chondrites and the Shallowater achondrite. — Authors' abstract

Alexander, Shelton S. *See* Newton, Carl A. 05203

05134 **Al-Khersan, Hashim Fadil.** Carbonate petrography of the Red Eagle Limestone (lower Permian), southern Kansas and north-central Oklahoma [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1194B, 1969.

05602 **Allan, R. J.; Brown, Jerry; Rieger, Samuel.** Poorly drained soils with permafrost in interior Alaska: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 599-605, illus., tables, 1969.

Physical, chemical, and mineralogical properties are presented for five soils. The soils are shallowly thawed, with permafrost usually at 60 cm or less, and with a thick accumulation of organic matter, usually about 25 cm deep, over a gleyed mineral soil. They are classified as Histic Pergelic Cryaquepts in the comprehensive soil classification system adopted by the USDA. — Soil brief

Allen, Richard. *See* Wu, Francis T. 05166

05340 **Almy, Charles C.** Sedimentation and tectonism in Upper Cretaceous Puerto Rican part of Caribbean island arc [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2030-2031, 1969.

Alsinbili, M. B. *See* Pirson, S. J. 05045

Alsop, L. E. *See* Savino, J. 05170

05501 **Am. Soc. Civil Engineers.** (Soil Mechanics and Found. Div. Comm. Soil Properties). Standardization of particle-size ranges: Am. Soc. Civil Engineers Proc., v. 95, paper 6795, Jour. Soil Mechanics and Found. Div., no. SM5, p. 1247-1252, 1969.

This report summarizes activities of an Intersociety Committee for Standardization of Particle-Size Ranges, and emphasizes the role of ASCE; the ASCE position paper, as presented to that committee, is appended. The Intersociety Committee observed that upper size limits in mm, now in use, are: clay, 0.002, 0.0039, and 0.005; silt, 0.05 (no. 270 sieve), 0.0625 (no. 230 sieve), and 0.074 (no. 200 sieve); sand, 2.0 (no. 10 sieve), and 4.76 (no. 4 sieve). It agreed on: "The prospects of attaining agreement on the upper size limits of clay seems good and we recommend the 0.002 mm limit. The possibilities of attaining agreement on the upper size limit of silt are slight to moderate, 0.0625 mm and 0.074 mm seem reasonable alternatives, with slight preference for the 0.074 limit. The prospect of attaining agreement on the upper sand size limit seems moderate to good and we recommend the 2.0 mm limit." — *from* ASCE abstract

05029 **Anderson, Franz E.; Hess, Frederick R.** An inexpensive coring platform for shallow estuarine waters: Jour. Sed. Petrology, v. 39, no. 3, p. 1238-1242, illus., 1969.

Coring problems in shallow estuarine waters have been overcome by the construction of a catamaran type coring platform. The catamaran, whose draft is less than 6 inches, provides the estuarine scientists with a stable, portable, inexpensive means for collecting core samples. —Authors' abstract

Anderson, James A. *See* Bauer, Herman L., Jr. 05576

05341 **Andress, Noel E.; Cramer, Fritz H.; Goldstein, Robert F.** Ordovician chitinozoans from Florida well samples [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2031, 1969.

Andress, Noel E. *See* Goldstein, Robert F. 05364

05342 **Antoine, John W.** Geophysical studies of northern Florida platform, Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2031, 1969.

Arabasz, Walter. *See* Brune, James N. 05191

05084 **Archbold, N. L.** Industrial mineral deposits, *in* Geology and mineral deposits of Lyon, Douglas, and Ormsby Counties, Nevada: Nevada Bur. Mines Bull. 75, p. 31-41, illus., 1969.

A reconnaissance study was made of all industrial mineral or nonmetallic deposits that could be located in Lyon, Douglas, and Ormsby Counties by referring to the geologic literature of Nevada and other field records. Deposits of the various types, briefly described with some geologic sketch maps, include diatomite, gypsum, fine abrasives, barite and fluorite, cinders and perlite, graphite, limestone, sulfates, clay, silica, coal and lignite, dimension stone, and gravel. —GDC

05343 **Arden, Daniel D., Jr.** Geologic history of Nicaraguan Rise [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2031, 1969.

05296 **Armbrust, George A.** Hydrothermal alteration of a breccia-pipe deposit, Tribag mine, Batchawana Bay, Ontario: Econ. Geology, v. 64, no. 5, p. 551-563, illus., tables, 1969.

The mine is in one of a group of breccia pipes that cut a pre-Keweenawan terrane of metavolcanics, metasediments, and granitic intrusives. "The breccia contains angular to subrounded fragments of trondhjemite or sodic granite, basic volcanics, felsite, and diabase. . .in a matrix of quartz, pyrrhotite, chalcopyrite, sphalerite, marcasite, and galena. Minor amounts of molybdenite, scheelite, fluorite, laumontite, and barite also occur in the matrix. . . Hydrothermal alteration and the extrusion of basaltic magma nearby have both been dated at near 1,050 m.y." suggesting a possible genetic relation between the copper deposit and nearby Middle Keweenawan extrusives. —WSW

05206 **Armstrong, C. A.** Geology and ground water resources of Williams County, North Dakota — Pt. 3, Ground water resources: North Dakota Geol. Survey Bull. 48, pt. 3 (North Dakota Water Conserv. Comm. County Ground Water Study 9), 82 p., illus., tables, 1969.

Ground water in Williams County is obtained from Quaternary glacial drift aquifers, Tertiary Fort Union Group, and Cretaceous Dakota Group. Three of the more productive aquifers, Little Muddy, Ray, and Grenora, are composed of sand and gravel deposited in the ancestral Yellowstone, Little Missouri, and Missouri River valleys, respectively. Properly constructed wells in more permeable parts of aquifers can yield more than 500 gpm; larger yields are obtainable in the proglacial Yellowstone and Missouri River valleys. Yields of 50-500 gpm are obtainable from some outwash and buried glaciofluvial deposits in the northern section and from some of the finer sand deposits in the five major aquifers. Water from glacial drift aquifers differs greatly in quality; generally it is hard and of calcium bicarbonate type. Water in

the Fort Union and Dakota Groups is generally highly saline. — *from* Author's abstract

Armstrong, J. E. *See* Leaming, S. P. 05419

Ash, Sidney R. *See* Breed, William J. 05615

Auvil, Jesse H. *See* Smith, James W. 05414

05543 **Axelrod, Daniel I.; Bailey, Harry P.** Paleotemperature analysis of Tertiary floras: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 6, no. 3, p. 163-195, illus., tables, 1969.

Mean annual temperature (T) and mean annual range of temperature (A) closely delineate the thermal field that circumscribes the distribution of modern plant communities. The data provide a reliable measure of paleotemperature for Tertiary floras whose composition corresponds to living communities. Previous studies of Tertiary floras in the western United States show a rather regular trend toward lowered temperature and greater extremes with diminishing age. Although some investigators have superimposed major temperature fluctuations on that trend, those irregularities appear to reflect no more than regional temperature differences stemming from various geographic factors, as well as imprecise temperature criteria selected to estimate paleotemperature. — Authors' summary

Baadsgaard, H. *See* Chrismas, L. 05158

Bailey, Harry P. *See* Axelrod, Daniel I. 05543

05344 **Ball, Mahlon M.** Origin of Gulf of Mexico and Caribbean Sea — Implications regarding ocean ridge extension, migration, and shear [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2031-2032, 1969.

05345 **Ball, Mahlon M.; Oglesby, Woodson R.** Gravity survey of Florida Bay and lower Keys [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2032, 1969.

05042 **Balster, Clifford A.; Parsons, Roger B.** Late Pleistocene stratigraphy, southern Willamette Valley, Oregon: Northwest Sci., v. 43, no. 3, p. 116-129, illus., 1969.

The Willamette Valley averages about 25 miles wide between the foothills of the Cascade and Coast Ranges; the river flows on a narrow floodplain that is grossly underfit in the broad valley. Stratigraphy of late Pleistocene valley-fill deposits underlying the Calapooyia-Senecal surfaces, the most extensive of the older terrace levels, is interpreted for the part of the valley south of Albany from cut-bank exposures and 100 deep hand-auger holes. The previously mapped Linn Gravel and overlying Willamette Silts are revised, and new units are proposed: Rowland Formation to include Linn Member and overlying Diamond Hill Member topped by paleosols; Willamette Formation to include progressively younger Wyatt, Irish Bend, Malpass, and Greenback Members, with deformation and planation of the valley floor preceding Malpass deposition. —VMJ

05135 **Balthaser, Lawrence Harold.** Petrology and paleoecology of middle Chester (Mississippian) rocks of the southwestern Indiana outcrop [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1194B-1195B, 1969.

05622 **Bamber, E. W.** Redescription of type specimens of the Upper Mississippian coral *Ekvasophyllum cascadense* (Warren) from Alberta [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 107-112, illus., 1969.

Ekvasophyllum cascadense is early late Visean (late Meramecian) in age, and is widespread in the upper Mount Head Formation and the upper Prophet Formation of the Rocky Mountains of Alberta and British Columbia. *Ekvasophyllum turbineum* Parks appears to be a junior synonym of *E. cascadense*. — Author's abstract

05268 **Barrett, Charles S.; Newkirk, John B.; Mallett, Gavin R.** (editors). Advances in X-ray analysis, V. 12 — Applications of X-ray Analysis, 17th Ann. Conf., Denver, Colo., 1968, Proc.: New York, Plenum Press, 648 p., illus., tables, 1969.

Of the 39 papers presented at the Conference, five are cited separately. —ESL

05670 **Barshad, Isaac.** Preparation of H saturated montmorillonites: Soil Sci., v. 108, no. 1, p. 38-42, tables, 1969.

To overcome the difficulties of saturating montmorillonite with H^+ ions a method was devised which is rapid, efficient, and does not affect the cation exchange capacity. The method consists of passing dilute (1 to 2 percent) Na saturated clay suspensions through a series of exchange resin (R) columns arranged in the order of: (H-R), (OH-R), and (H-R). Suction is used to accelerate the rate to about 200 ml per 2-5 minutes. — JWH

05455 **Bartlett, Robert W.** Magma convection, temperature distribution, and differentiation: Am. Jour. Sci., v. 267, no. 9, p. 1067-1082, illus., tables, 1969.

Normal heat fluxes from the Earth are sufficient to cause magma convection in plutons greater than 15 m for magma viscosities to 10^{-8} poise. Convection increases markedly with size of the magma chamber and becomes the dominant method of heat transfer within the magma. Large solidifying intrusions have an approximately isothermal temperature distribution during part of the crystallization history. Natural convection also redistributes settling crystals. The population distribution (differentiation) of crystals in the vertical direction depends on the settling and convective back diffusion fluxes. An equation for population distribution is derived, and calculations made for olivine and quartz crystals in ultramafic and granitic magmas are in agreement with observed distribution of these minerals in corresponding solidified intrusions. — *from* Author's abstract

Basler, J. A. *See* Koopman, F. C. 05168

05033 **Bassarab, D. R.; Huff, W. D.** Clay mineralogy of Kope and Fairview Formations (Cincinnatian) in the Cincinnati area: Jour. Sed. Petrology, v. 39, no. 3, p. 1014-1022, illus., table, 1969.

Detailed study of the clay mineralogy of portions of the Kope and Fairview (Cincinnatian) Formations, of Cincinnati, Ohio, reveals a suite composed of illite, chlorite, vermiculite, and some mixed illite-montmorillonite. In the vicinity of the Kope-Fairview contact the relative amounts of chlorite and vermiculite decrease, and then show some increase near the top of the Fairview. Comparisons with paleocurrent data show a correlation between dominant current directions and chlorite-illite ratios, and suggest a stronger easterly source for the Kope and a slightly greater influx of northern sediments for the Fairview. —Authors' abstract

Bassinger, B. G. *See* Weeks, L. A. 05335

Bath, G. D. *See* Miller, C. H. 05251

05576 **Bauer, Herman L., Jr.; Breitrick, Richard A.; Cooper, James J.; Anderson, James A.** Porphyry copper deposits in the Robinson mining district, Nevada, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. [9/3-9/14], illus., tables, reprinted 1969; originally published 1966.

This paper was first published *in* Geology of the porphyry copper deposits, southwestern North America, Tucson, Ariz., Arizona Univ. Press, p. 232-244, 1966. *See* Abstracts of North American Geology for February 1967.

05346 **Beard, John H.** Pleistocene paleotemperature record based on planktonic foraminifers, Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2032, 1969.

05503 **Beck, A. E.; Judge, A. S.** Analysis of heat flow data — [Pt.] 1, Detailed observations in a single borehole: Royal Astron. Soc. Geophys. Jour., v. 18, no. 2, p. 145-158, illus., tables, 1969.

Heat flow data from a 600-m deep borehole has been used to estimate how short a section of borehole will give a valid heat flow value, to test for recent and ancient climatic changes, underground waterflows and variation of terrestrial heat flow with depth. Temperatures were repeatedly measured at 3-m intervals; measurements of thermal conductivity, density and porosity were made on specimens sampled at approximately 4-m intervals along the length of the hole. After correcting for the Wisconsinan glaciation the mean heat flow value is 1.17 h.f.u., but some 30 to 100-m sections of the borehole differ by ± 20 percent from the mean values. The differences cannot be entirely explained as being due to structure, topography, climatic changes or underground waterflows. — *from* Authors' abstract

05518 **Becker, Herman F.** Fossil plants of the Tertiary Beaverhead basins in southwestern Montana: Palaeontographica, Abt. B, v. 127, nos. 1-6, p. 1-142, illus., tables, 1969.

Several florules are present within massive sediments in Beaverhead County over an area of about 240 sq mi. Forty-eight families, with 110 genera and 160 species are present, of which 21 species are described as new. The Gymnospermae and Leguminosae are each represented by 13 genera, followed by the Rosaceae with 7, the Rhamnaceae with 6, and the Betulaceae with 5. *Quercus* has 9 species present, *Mahonia* 8, *Acer* 6, *Salix* 4, and *Abies*, *Picea*, *Betula*, *Cassia*, *Cercocarpus*, *Fraxinus*, and *Zelkova*, 3 each. A lake at 1500 to 2000 feet elevation was the depositional reservoir, and was surrounded by highlands up to 6000 feet. The minimum temperature, not much below freezing, and a fairly even, annual precipitation between 40 and 50 inches are indicated. — *from* Author's abstract

Beckmann, G. G. *See* Hallsworth, E. G. 05643

Begon, J. C. *See* Pedro, C. 05649

05663 **Bell, J. P.** A new design principle for neutron soil moisture gages — The "Wallingford" neutron probe: Soil Sci., v. 108, no. 3, p. 160-164, illus., 1969.

The neutron scattering method for measuring changes in soil moisture has now become accepted and is in wide use. The article describes a new probe for taking these measurements. — JWH

Bell, Peter M. *See* Brett, Robin. 05085

05445 **Bennett, Gerald.** Geology of the Belford-Strachan area, District of Cochrane: Ontario Dept. Mines Geol. Rept. 78, 30 p., illus., tables, geol. maps, 1969.

The townships of Belford, Montcalm, Nova, and Strachan cover an area of 324 sq mi; all major rock units are Precambrian. The belt of mafic and felsic metavolcanics with intercalated metasediments that underlies the central section is intruded by an arcuate body of magnetite-rich gabbro with minor amounts of associated serpentinite and diorite. The eastern edge is underlain by a batholith of felsic intrusive rocks which intrudes the metavolcanics and gabbro. Another body of granitic rocks is present along the western edge, but its relation to surrounding rocks is uncertain. A complex of granulite facies gneisses, faulted against the metavolcanics in the NW corner of Belford Township, forms part of a horst which belongs to the Kapuskasing structure. Matachewan-type diabase dikes cut all major rocks except granulites and granitic rocks west of the central belt. No deposits of economic significance have been found. — *from* Author's abstract

Berberian, Paul. *See* Estes, Richard. 05512

Berkeley, Dorothy. *See* Berkeley, Edmund. 05298

05298 **Berkeley, Edmund; Berkeley, Dorothy.** Instructions for North American geological investigation, 1756, by Nicholas Crisp: Econ. Geology, v. 64, no. 5, p. 569-571, 1969.

A letter dated August 18, 1756, from Nicholas Crisp, a charter member of the Royal Society of Arts in London, lists observations and tests that should be made by Dr. Alexander Garden of Charleston, S. C., to determine the presence of mineral deposits in an expedition to the Blue Ridge Mountains that was being planned. — WSW

Berkheiser, V. E. *See* Syers, J. K. 05644

05273 **Berry, P. F.; Furuta, T.; Rhodes, J. R.** Particle size effects in radioisotope X-ray spectrometry, *in* Advances in X-ray analysis, V. 12 — Applications of X-ray Analysis, 17th Ann. Conf., Denver, Colo., 1968, Proc.: New York, Plenum Press, p. 612-632, illus., 1969.

Theories explaining the dependence of characteristic X-ray intensity on particle size in heterogeneous materials are reviewed. Several discrepancies between the theories and between theory and experiment have been discovered. A new theory is proposed based on a more rigorous physical model. It is shown to explain well-established phenomena at least as precisely as do previous formulae. Excellent agreement is also obtained with new observations of the variation of characteristic X-ray intensity with packing degree and, in samples consisting of only one type of particle, with both packing degree and particle size. The same basic theory also predicts the observed variation of X-ray intensity backscattered from or transmitted through a sample. It is also shown that similar results are obtained with particles suspended in a homogeneous matrix, such as an aqueous slurry. — —Authors' abstract

05627 **Birkelund, T.; Perch-Nielsen, K.** Field observations in upper Palaeozoic and Mesozoic sediments of Scoresby Land and Jameson Land: Grönlands Geol. Undersögelse Rap. 21, p. 21-35, illus., table, 1969.

A reconnaissance study of a few exposures of Devonian and Permian rocks indicates that most of the area is underlain by Triassic and Jurassic rocks, all of which may be included in seven recognizable formations. These formations are described and some of the faunas listed. Tertiary intrusives are present throughout the region. Faults are common, and folding is present in the Kap Biot area and south of Kolledalen. The age of the faults and folds is probably Tertiary, although the main faults follow Paleozoic lineaments. Quaternary moraines are scarce in the north but widespread in the south. — HRC

05347 **Bishop, William F.** Environmental control of porosity in upper Smackover Limestone, North Haynesville Field, Claiborne Parish, Louisiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2032-2033, 1969.

Bisque, Ramon E. *See* Pyrih, Roman Z. 05264

05427 **Bjerrum, Laurits.** Progressive failure in slopes of overconsolidated plastic clay and clay shales — Closure [to discussion of paper 5456]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM5, p. 1255, 1969.

In answer to the late Robert Peterson's discussion (ibid., v. 95, no. SM1, p. 336-337, 1969) of this paper (ibid., v. 93, no. SM5, pt. 1, p. 1-49, 1967), the writer agrees with his explanation of the difference in swelling of the Bearpaw Clay Shale as observed in field and laboratory tests. The only method known by this writer to investigate whether a clay or clay shale belongs to the "dangerous type" is to subject a sample in a consolidometer to a number of cycles of loadings and unloadings. If this leads to an increase in water content above the natural content, the sample contains "locked in" recoverable strain energy. The number of cycles required to produce certain swelling will be a measure of the strength of the diagenetic bonds responsible for the delayed liberation of the recoverable strain energy. — GDC

05544 **Bjork, Philip Reese.** The Carnivora of the Hagerman local fauna (late Pliocene) of southwestern Idaho [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 763B, 1969.

05068 **Black, D. C.; Pepin, R. O.** Trapped neon in meteorites, [Pt.] 2: Earth and Planetary Sci. Letters, v. 6, no. 5, p. 395-405, illus., 1969; correction, ibid., no. 6, p. 498.

From heating experiments on carbonaceous chondrites and gas-rich meteorites, trapped Ne-20/Ne-22 ratios are observed to vary by more than a factor of 4. The description of trapped neon in meteorites as a variable mixture of two components is qualitatively valid for total neon, but cannot account for extreme compositions revealed in these individual temperature fractions. At least two other components, with Ne-20/Ne-22<3.4 and >14, are required. The ratio in Neon-B is very close to 12.5 in all four of the gas-rich meteorites examined. Evidence is presented for a third major neon component, Ne-20/Ne-22 = 11.2, in all carbonaceous chondrites and in most gas-rich meteorites. There is no firm evidence for *in situ* mixing, and no sign that diffusive fractionation is responsible for any isotopic variations. The great range of the variations effectively eliminates volume diffusion alone as a feasible mechanism. — *from* Authors' abstract

Black, William L. *See* Hardin, Bobby O. 05432

Blackwelder, Blake W. *See* Pilkey, Orrin H. 05323

05629 **Blagbrough, John W.; Breed, William J.** A periglacial amphitheater on the northeast side of Navajo Mountain, southern Utah: Plateau, v. 42, no. 1, p. 20-26, illus., 1969.

The large horseshoe-shaped amphitheater on the northeast slope of Navajo Mountain at the head of Cha Canyon has a valleyward sloping floor with an elevation of about 8000 feet, and steep walls which rise 1000 to 2000 feet above. Talus covers extensive areas on the walls and embanked gullies are on the floor. The amphitheater is thought to have been formed in the late Pleistocene by periglacial processes acting upon water-eroded topography. Frost action smoothed the rough and uneven walls, and nivation formed the floor by widening and rounding the canyon bottom at its head. The amphitheater may be a landform transitional between a water-eroded canyon head and a glacial cirque. — Authors' abstract

05283 **Blume, H. P.; Schwertmann, U.** Genetic evaluation of profile distribution of aluminum, iron, and manganese oxides: Soil Sci. Soc. America Proc., v. 33, no. 3, p. 438-444, illus., tables, 1969.

Various methods for the extraction of pedogenic oxides of Al, Fe, and Mn are described and their applicability for interpreting soil profile genesis is demonstrated. Representative great soil groups can be differentiated by typical depth functions of the pedogenic oxides. Furthermore, intergrades between the end members, which cannot be recognized in the field, have distinctly different depth functions. As an example cryptopodzolization can be recognized by a maximum of "free Al" in the subsoil. By means of these depth functions three types of imperfectly drained Gray Brown Podzolic Soils with and without lateral iron removal and with lateral iron addition may be distinguished. —Authors' abstract

05348 **Bock, Wayne D.** *Thalassia testudinum*, habitat and means of dispersal for shallow-water benthonic Foraminifera [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2033, 1969.

Bodvarsson, Gunnar. *See* Mesecar, Roderick S. 05488

05603 **Boelter, D. H.** Physical properties of peats as related to degree of decomposition: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 606-609, illus., tables, 1969.

Water retention, water yield coefficient, and hydraulic conductivity of representative northern Minnesota peats were related to degree of decomposition as measured by

fiber content and bulk density. The classification of these peat materials and organic soils based primarily on degree of decomposition would relate significant information about their physical characteristics. — Soil brief

05380 **Boettcher, A. L.; Wyllie, P. J.** Phase relationships in the system $NaAlSiO_4$-SiO_2-H_2O to 35 kilobars pressure: Am. Jour. Sci., v. 267, no. 8, p. 875-909, illus., tables, 1969.

Phase relationships in the system are first presented on P-T projections of three different composition joins. Crystalline phases encountered include albite, analcite, coesite, jadeite, nepheline, and quartz. Vapor-saturated melting curves proceed with negative dP/dT slopes to invariant points of pressures between 10 and 13 kb. Together with chemographic methods of Schreinemakers and experimental data for the system $NaAlSiO_4$-SiO_2, univariant and invariant equilibria for the ternary system are presented on P-T projection. Isobaric polythermal diagrams, constructed on the basis of the melting relationships and solubility data illustrate the primary fields for the crystalline phases and disclose that critical phenomena will intervene only for compositions rich in SiO_2. — *from* Authors' abstract

05030 **Boggs, Sam, Jr.** Relationship of size and composition in pebble counts: Jour. Sed. Petrology, v. 39, no. 3, p. 1243-1247, illus., tables, 1969.

Analyses of gravel samples from the Sixes River in southwestern Oregon show that the relative abundance of individual rock types in these samples varies with the mean size of the particles. At localities where fluvial processes have sorted gravels into groups of different mean grain size, pebble counts reveal that sandstone and argillite are consistently more abundant in the finer gravel population than in the coarser, whereas conglomerate, igneous, and metamorphic rock types are generally more abundant in the coarser population. These variations result largely from the relative availability of specific sizes of each rock type at a given locality. Relative availability is mainly a function of the size of the material weathered from bedrock, and of the susceptibility of this material to further breakdown during transport. —Author's abstract

05458 **Bold, W. A. van den.** *Messinella*, a new genus of Ostracoda in the Caribbean Cenozoic: Micropaleontology, v. 15, no. 4, p. 397-400, illus., 1969.

A new genus of Ostracoda is described from the Caribbean Tertiary. Two species are recognized, *Messinella guanajayensis* from the Oligocene of Cuba and *Messinella jamaicensis* from the upper Miocene-Pleistocene of Jamaica. — Author's abstract

Bolt, Bruce A. *See* Nuttli, Otto W. 05192

05193 **Bolt, Bruce A.** Features of the upper mantle, and the boundaries of the outer and inner core [abs.]: Earthquake Notes, v. 40, no. 2, p. 11, 1969.

05349 **Bonatti, E.; Boström, K.; Eyl, B.; Rona, E.** Geochemistry, mineralogy, and absolute ages of Caribbean sediment core [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2033, 1969.

05497 **Bond, T. A.** Corrections of diatom misidentifications ["A post glacial diatom assemblage from Caddo County, Oklahoma," 1968]: Micropaleontology, v. 15, no. 4, p. 504, 1969.

Specific and generic misidentifications of Quaternary diatoms from Oklahoma are corrected [for the original paper, ibid., v. 14, no. 4, p. 484-488, 1968]. — Author's abstract

05561 **Booy, Emmy Catherine.** Mineralogy and physical properties of clays involved in certain Cordilleran landslides [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 706B-707B, 1969.

05595 **Bornemisza, Elemer; Morales, José C.** Soil chemical characteristics of recent volcanic ash: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 528-530, illus., tables, 1969.

Volcanic ash, emitted by Irazú volcano in Costa Rica during 1963 and 1964, was evaluated for its agricultural value. The evaluation included leaching loss studies in lysimeters and measurements of nutrients extracted with various solutions. The CEC of the ash is about 1.85 meq/100 g, and its pH in water is 5.1; it contains little soluble or exchangeable Mn. Lysimeter experiments showed that Irazú ash does not fix phosphorus or retain cations added as fertilizers. The ash is wettable and forms, when wetted, a thin, hard, cemented surface crust. — Authors' abstract

05399 **Bostock, H. H.** The Clearwater Complex, New Quebec [with French abs.]: Canada Geol. Survey Bull. 178, 63 p., illus., geol. map, 1969.

The lake consists of two circular basins with central shoals and a concentric ring of islands 10 mi across in the west basin. Precambrian rocks are intruded by diabase and overlain on the island ring by Ordovician limestone-marble, intruded by a volcanic sequence, friable argillized breccia to coherent breccia to quartz latite. Argillization of plutonic rocks accompanied emplacement of friable breccias, and partial fusion, recrystallization, and formation of spurrite accompanied later intrusion. Quartz latite has a K-Ar age of 300 m.y. The average volcanic rock is higher in K_2O than the average plutonic. Composition of volcanic rocks and progression from low to high temperature are inconsistent with meteoritic origin. It is suggested that the west basin formed by collapse after doming over a magma chamber. Collapse was initiated by major exhaust of volatiles, replaced by eruption of magma along a ring fault. — *from* Author's abstract

Boström, K. *See* Bonatti, E. 05349

05481 **Boström, K.; Peterson, M. N. A.** The origin of aluminum-poor ferromanganoan sediments in areas of high heat flow on the East Pacific Rise: Marine Geology, v. 7, no. 5, p. 427-447, illus., tables, 1969.

Over large areas with high heat flow on the East Pacific Rise the sediments are abnormally poor in aluminum and titanium and rich in iron, manganese, boron, arsenic, cadmium, vanadium and chromium compared to pelagic sediments in general. Most likely the sediments have incorporated precipitates from volcanic emanations that debouch on the crest of the Rise. The mineralizing emanations probably originate in the crust or upper mantle, or both. — Authors' summary

Bottino, Michael L. *See* Fullagar, Paul D. 05633

Bouma, Arnold H. *See* Rezak, Richard. 05325

05350 **Bouma, Arnold H.; Sweet, William E., Jr.; Zupan, Alan-Jon.** Upper sediment column of Gulf of Mexico presented in new type of map [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2033, 1969.

Bouma, Arnold H. *See* Chmelik, Frank B. 05354

05113 **Bowles, Frederick Albert.** Electron microscopy investigation of the microstructure in sediment samples from the Gulf of Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1271B, 1969.

05075 **Bowles, R. C.** Ira A. Brinkerhoff, 1904-1969: Houston Geol. Soc. Bull., v. 13, no. 3, p. 22, 1969.

05265 **Boyle, R. W.** Further remarks on the origin of massive sulfide deposits [discussion of papers by Anderson (1969) and Lusk and Crocket, 1969]: Econ. Geology, v. 64, no. 7, p. 829, 1969.

Profound wall-rock alteration zones, the fine-grained textures, and failure of some sulfide bodies to follow structural and recrystallization trends of their wall rocks throws doubt on a metamorphic hypothesis for the Bathurst, New Brunswick, sulfide deposits. Shifts in sulfur isotope ratios seem best explained as an intrinsic feature of the original crystallization, and the uniformity of the shifts as the result of widespread diffusion. A pressure gradient between ore and country rock seems more likely than

a temperature gradient. [Original papers, ibid., no. 2, p. 129-146 (Anderson) and p. 147-155 (Lusk and Crocket).] — WSW

Brabb, Earl E. *See* Churkin, Michael, Jr. 05047

05164 **Bradley, W. H.; Eugster, H. P.** Geochemistry and paleolimnology of the trona deposits and associated authigenic minerals of the Green River Formation of Wyoming: U.S. Geol. and Survey Prof. Paper 496-B, p. B1-B71, illus., tables, geol. map, 1969.

The Green River Formation (Eocene) of Wyoming contains at least 27 beds of trona, or trona and halite, ranging in thickness from about 1 m to 11.5 m and in area from about 428 km^2 to 1,870 km^2. Beds more than 1 m thick contain 7.5×10^{10} metric tons of trona. The physical chemistry of several sodium carbonate-bicarbonate-chloride systems shows that the trona beds were deposited from evaporation of brines in shallow, well-stirred lakes in equilibrium with atmospheric CO_2. Under these conditions, 80 percent of the potential trona will crystallize before halite precipitates. Associated unusual authigenic minerals include the unique shortite ($Na_2CO_3 \cdot 2CaCO_3$). Experimental studies of shortite indicate that most of the authigenic minerals formed after compaction and at a temperature of about 90°C. — WHB

05180 **Brady, A. Gerald.** Project for digitization and analysis of strong-motion earthquake accelerograms [abs.]: Earthquake Notes, v. 40, no. 2, p. 18, 1969.

05163 **Brazee, R. J.** Further reporting on the distribution of earthquakes with respect to magnitude (m_B): Earthquake Notes, v. 40, no. 2, p. 49-51, illus., table, 1969.

This follow-up study to that for 1964-65, published in Seismol. Soc. America Bull., April 1969, catalogs the shocks for 1966-67, and all earthquakes for the four-year period. — ESL

05615 **Breed, William J.; Ash, Sidney R.** New fossil plants from the Chinle Formation: Plateau, v. 42, no. 1, p. 34-36, illus., 1969.

Stem fragments of tree ferns, but no leaves, were found, as was the stem of a cycad or bennetite which includes the base of the fruit. A portion of a cone was also found. All are illustrated but none are identified. The fern and cycad are from the Petrified Forest Member of the Triassic Chinle Formation and the cone was found on the surface near Joseph City. The cycad and fern are from near Winslow. — HRC

Breed, William J. *See* Blagbrough, John W. 05629

05664 **Brees, D. R.; Graham, E. R.** The effect of soil texture and organic matter on the self-diffusion coefficient of tritiated water in Missouri soils: Soil Sci., v. 108, no. 3, p. 165-169, illus., table, 1969.

The study revealed that clay has a marked effect on the diffusion of tritiated water. After the clay content reaches 40 percent of the soil system, there is a leveling off in the diffusion. Organic matter had little or no effect on the diffusion. — JWH

Breitrick, Richard A. *See* Bauer, Herman L., Jr. 05576

05136 **Brennan, William Joseph.** Structural and surficial geology of the west flank of the Gore Range, Colorado [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1195B, 1969.

05085 **Brett, Robin; Bell, Peter M.** Melting relations in the Fe-rich portion of the system Fe-FeS at 30 kb pressure: Earth and Planetary Sci. Letters, v. 6, no. 6, p. 479-482, illus., table, 1969.

The melting relations of Fe-FeS mixtures covering the composition range from Fe to $Fe_{67}S_{33}$ have been determined at 30 kb pressure. The phase relations are similar to those at low pressure. The eutectic has a composition of $Fe_{72.9}S_{27.1}$ and a temperature

of 990°C. Solubility of S in Fe at elevated temperatures at 30 kb is of the same order of magnitude as at low pressure. Sulfur may have significantly lowered the melting point of iron in the upper mantle during the period of coalescence of metal prior to core formation in the primitive earth. —Authors' abstract

05646 **Brewer, R.; Sleeman, J. R.** The arrangement of constituents in Quaternary soils: Soil Sci., v. 107, no. 6, p. 435-441, 1969.

Soil materials consist basically of skeleton grains, plasma, and organic fragments. The skeleton grains are relatively inert while plasma is easily rearranged by pedologic processes. The author discusses the rearrangement of the more common constituents of the plasma; for example, clay minerals, sesquioxides, manganese oxides, carbonates, sulphates, silica, and organic matter. — JWH

05460 **Brinkmann, R. T.** Dissociation of water vapor and evolution of oxygen in the terrestrial atmosphere: Jour. Geophys. Research, v. 74, no. 23, p. 5355-5368, illus., tables, 1969.

Previous studies of the photodissociation of water vapor and the resulting evolution of oxygen in the Earth's atmosphere have led to the conclusion that, over most of geologic time, the atmospheric oxygen abundance has been $<10^{-3}$ times the present atmospheric level. There appear, however, to be several objectionable features in these studies (that is, the neglect of both the path length dependence of the effective absorption coefficient in the O_2 Schumann-Runge bands and the importance of H_2O dissociation when H_2O is a minor absorber). New calculations have been performed in which these deficiencies are rectified. It now appears that the O_2 level could have reached an appreciable fraction of the present amount in the absence of biological activity. — Author's abstract

Brinkworth, George L. *See* Larson, Edwin E. 05477

05258 **Brown, Donald L.** Geologic map of the Jacks Creek quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 12A-NE, scale 1:24,000, separate text, 1969.

The accompanying text, "Mineral resources summary of the Jacks Creek quadrangle, Tennessee," by C. R. Sykes is cited separately. — MCM

Brown, Donald L. *See* Moore, Gerald K. 05309

Brown, J. M. *See* Dalziel, I. W. D. 05533

Brown, Jerry. *See* Allan, R. J. 05602

05351 **Brown, Leonard F., Jr.** Geometry of fluvial and deltaic sandstones (Pennsylvanian and Permian), north-central Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2033, 1969.

05218 **Brown, William Randall.** Geology of the Dillwyn quadrangle, Virginia: Virginia Div. Mineral Resources Rept. Inv. 10, 77 p., illus., tables, geol. map, 1969.

This area in the west-central Piedmont of Virginia is underlain by metamorphosed sedimentary and igneous rocks, mostly lower Paleozoic, some probably Precambrian. A basin of Triassic(?) conglomerates and arkosic sandstones with numerous dikes and sills extends into the southeastern part. A northwest-trending syncline has a deep infold of Late Ordovician fossiliferous slate, the Arvonia Formation, unconformable beneath conglomerate schists of the Buffards Formation and unconformably overlying, along the west flank, the Evington Group(?); on the east flank older rocks occur in the Whispering Creek anticline; and to the northeast are gneissic igneous rocks of the Hatcher complex. West of the Arvonia syncline Evington rocks are folded in the large overturned Hardward anticline, in the axis of which are metamorphosed plutons. Arvonia slate is the chief mineral resource. —GDC

05187 **Brune, James N.** Source dimensions of earthquakes and underground explosions of magnitude near 4.0 [abs.]: Earthquake Notes, v. 40, no. 2, p. 22, 1969.

05191 **Brune, James N.; Arabasz, Walter; Engen, Gladys R.** Locations of small earthquakes near the trifurcation of the San Jacinto fault southeast of Anza, California [abs.]: Earthquake Notes, v. 40, no. 2, p. 25, 1969.

05305 **Bryan, Alan L.** Early man in America and the late Pleistocene chronology of western Canada and Alaska [with comments by 17 authors and reply]: Current Anthropology, v. 10, no. 4 [pt. 1], p. 339-365, illus., 1969.

The history of entry of early man into North America and subsequent dispersal are reviewed and interpreted within the framework of late glacial chronology of northwestern North America. From available evidence, it is hypothesized that earliest man must have crossed the Bering land bridge earlier than 35,000 years ago in order to move southward through the ice-free corridor between the Cordilleran and Keewatin ice sheets before it closed about 25,000 years ago, as the land bridge was submerged between 35,000 and 25,000 years ago. All American bifacially flaked stone projectile point traditions evolved south of the coalescent ice sheets, from the Large Leaf-Shaped Biface tradition; as the ice receded, these traditions moved northward east of the Rockies. About 8,000 years ago, microblade traditions related to the Arctic began expanding southward from unglaciated Yukon and Alaska. — VMJ

05074 **Bryan, Roger W.** Marion Medford Hooks (1924-1969): Houston Geol. Soc. Bull., v. 12, no. 3, p. 21, 1969.

05562 **Bucknam, Robert Campbell.** Structure and petrology of Precambrian rocks in part of the Glen Haven quadrangle, Larimer County, Colorado [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 707B, 1969.

05635 **Buddington, A. F.** Some problems in estimation of physical conditions for development of Adirondack rocks: Empire State Geogram, v. 7, nos. 1-3, p. 7-16, illus., tables, 1969.

Temperature, total pressure, and water-pressure data from mineral assemblages in paragneisses of the Northwest Adirondack Lowlands preclude anatexis in place. Regional metamorphic mineral assemblages in gneisses of the Highlands are consistent with temperatures no higher than 600°-700°C and total pressure of 5.7 kb. Physical conditions indicated are inconsistent with extensive anatexis in place. An hypothesis proposed by deWaard (1967) predicated largely on a postulated anatexis in place, is that the rocks of the Highlands were, at an early stage, at a temperature of 800°C, total pressure of 10 kb, and a water pressure of 1,800 atm followed by re-equilibration under lower temperature and total pressure to yield the present assemblages. This hypothesis is not on a firm basis at present, but suggests lines for continuing research. — *from* Author's conclusions

Burckley, Raymond A. *See* Ramsey, William L. 05388

Burt, Wayne V. *See* Mesecar, Roderick S. 05488

Bush, Patricia A. *See* Bush, Sam A. 05352

05352 **Bush, Sam A.; Bush, Patricia A.** Isostatic gravity map of eastern Caribbean region [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2033-2034, 1969.

Cady, J. G. *See* Flach, K. W. 05647

05385 **California Dept. Water Resources.** Ground-water measurements, App. C; Ground water quality, App. E, *in* Hydrologic data, 1967 — V. 2, Northeastern California: California Dept. Water Resources Bull. 130-67, v. 2, p. 343-412, 623-667, illus., tables, 1969.

Tabulated information in these appendices includes: average changes of groundwater levels and summary of well measurements reported, ground-water levels at wells, mineral analyses of ground water, and trace element analyses of ground water. — MCM

Campanella, Richard G. *See* Mitchell, James K. 05431

05253 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheet 85, District of Mackenzie: Ottawa, Ontario, Geol. Survey Canada, scale 1:1,000,000, 1969.

05254 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheets 105, 115E, 106, 116: Ottawa, Ontario, Geol. Survey Canada, 2 sheets, scale 1:1,000,000, 1969.

05415 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheet 74, Saskatchewan-Alberta: Ottawa, Ontario, Canada Geol. Survey, scale 1:1,000,000, 1969.

05416 **Canada Geological Survey.** Geological maps published by the Geological Survey of Canada — Index Sheet 107, 117, Yukon Territory, District of Mackenzie: Ottawa, Ontario, Canada Geol. Survey, scale 1:1,000,000, 1969.

05418 **Canada Geological Survey.** Report of activities — Pt. B, November 1968 to March 1969: Canada Geol. Survey Paper 69-1, pt. B, 80 p., illus., tables, 1969.

This report comprises thirty-seven short papers [on analytical chemistry, coal research, exploration geophysics, geochemistry, geomathematics, mineral deposits, mineralogy, Precambrian geology, Quaternary research and geomorphology, stratigraphy, and general (photography of alpha tracks, and mineral display)] that describe research carried out by members of the Geological Survey of Canada between November 1968 and March 1969. — Author's abstract

05475 **Caner, B.** Long aeromagnetic profiles and crustal structure in western Canada: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 3-11, illus., 1969.

Long-wave length (>150 km) magnetic anomalies are found to be smoothed in the region southwest of the Rocky Mountain Trench, similar to the pattern observed on the U.S. Transcontinental Profile. The same region is also characterized by high electrical conductivity in the lower crust and upper mantle. Possible interpretations are: upwelling of the Curie point isotherm, breakup of structures by tectonic and metamorphic mechanisms, and/or more silicic crust. — Author's abstract

05204 **Carder, D. S.** Non-reversed seismic profile—Piute Mesa, Nevada, to San Francisco Bay [abs.]: Earthquake Notes, v. 40, no. 2, p. 8, 1969.

05021 **Carmichael, R. S.** Hydrostatic pressurization of magnetite: Geophysics, v. 34, no. 5, p. 775-779, illus., 1969.

Study of the effect of mechanical deformation on magnetic minerals indicates the structure-sensitive character of a parameter such as coercive force. Magnetoelastic effects and stress-induced rearrangement of the magnetic domain pattern lead to changes in magnetic remanence. This paper reports the results of the application of hydrostatic pressure up to 8 kilobars on single crystals of magnetite. Coercive force and saturation remanent magnetization are studied. —GV

05583 **Carolina Geological Society.** A guide to the geology of northwestern South Carolina, October 1969: South Carolina Div. Geology Geol. Notes, v. 13, no. 4, p. 85-147, illus., table, geol. maps, 1969.

This guidebook contains two technical papers dealing with specific regions and problems of South Carolina and a description of eleven stops on a field trip. No road log is included, but each stop is clearly identified. A preliminary geologic map and a preliminary tectonic map of northwestern South Carolina are included. — HRC

05230 **Carpenter, Robert H.; Fagan, James M.; Wedow, Helmuth, Jr.** Evidence on the age of barite, zinc, and iron mineralization in the lower Paleozoic rocks of East Tennessee [abs.]: Econ. Geology, v. 64, no. 3, p. 348, 1969.

Carrales, M., Jr. *See* Park, W. G. 05243

05307 **Carvajal, Marta Campa; Landergren, Sture.** Marine sedimentation processes — The interrelationships of manganese, cobalt and nickel: Stockholm Contr. Geology, v. 18, p. 99-122, illus., tables, 1969.

Studies of the behavior of Mn, Co, and Ni in sea water and marine sediments indicates that variations in depositional environments, such as redox potential, pH and the amount of detrital (allogene) material are the principal factors affecting concentrations and interrelations of these three elements in marine sediments. Three trends in distribution are noted: Low Co/Ni ratio of near-shore sediments may be due to the tendency of Co to form soluble complex ions; adsorption of Co^{2+} and Ni^{2+} ions, preferentially on negatively-charged MnO_2 colloids, is the main cause of enrichment of Co and Ni in deep-sea clay; and precipitation of Co and Ni in anoxic environments tends to move Co/Ni ratio in stagnant sediments toward that estimated for sea water. Presence of detrital material shifts the ratio toward that of the Earth's crust. — *from* Authors' abstract

Cecil, C. B. *See* Renton, J. J. 05106

05353 **Čepek, Pavel; Hay, William W.** Calcareous nannoplankton and biostratigraphic subdivision of Upper Cretaceous [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2034, 1969.

05379 **Chapman, Carleton A.** Oriented inclusions in granite—Further evidence for floored magma chambers: Am. Jour. Sci., v. 267, no. 8, p. 988-998, illus., 1969.

Nearly 200 readings on inclusions in the Cadillac Mountain pluton of Maine show a delicate but well-developed planar structure due to parallel inclusions which is roughly horizontal over most of the granite pluton and inclines centripetally up to about 25° in the marginal zone. This saucer-shaped structure is analogous to mineral layering in the Skaergaard intrusion and developed as a sedimentational feature in the magma chamber formed by cauldron subsidence. Convection currents must have been active during the consolidation stage and appear to account for the size range, size distribution, shape, and state of alteration of the xenoliths and in part for their orientation. The marked differences between the inclusions constituting the saucer-like structure pattern and the more angular, diversely oriented xenoliths of the contact zone are petrogenetically significant in this and perhaps in other plutons. — *from* Author's abstract

05209 **Chapman, Robert M.; Foster, Robert L.** Lode mines and prospects in the Fairbanks district, Alaska: U.S. Geol. Survey Prof. Paper 625-D, p. D1-D25, illus., tables, 1969.

Lode mines and prospects in the Fairbanks district are known chiefly for their gold content, but some antimony, tungsten, and lead-silver have been produced. Auriferous deposits are mainly concentrated in the Pedro Dome-Cleary Creek area, scheelite deposits in the Gilmore Dome-Tungsten Hill area, and a small group of stibnite deposits near the head of Vault and Treasure Creeks; placer gold deposits are closely associated with these source areas. Lode deposits, mainly in the Birch Creek Schist, are closely associated with porphyritic granite, quartz monzonite, quartz diorite, and granodiorite of probable Mesozoic age. Semiquantitative spectrographic analyses for 30 elements and gold analyses were made on 130 samples representative of igneous rocks and others associated with the lodes. Anomalous amounts of gold, 0.1-24 ppm, were found in 28 samples and anomalous amounts of 8 or more elements in 26 samples. —*from* Authors' abstract

05217 **Chard, Chester S.** Man in prehistory: New York, McGraw-Hill Book Co., 350 p., illus., 1969.

Primarily designed as a text for a one-semester college course in introductory world prehistory at the freshman or sophomore level, this volume could also prove of interest to the general reader who wishes to acquire a brief overview of the human background and an introduction to archeology. The 24 chapters of the book are: archeology, methods in archeology, dating the past, world of the Pleistocene, protoculture and its antecedents, achievement of humanity, Man in the lower Pleistocene, middle Pleistocene, Neanderthaloid phase, *Homosapiens* phase, postgla-

cial survivals of the hunting pattern, shift to food production, domestication and concurrent advances, first farmers, urbanism, courses toward urban life, and the great transformation. Some of the above titles comprise more than one chapter. Suggested readings are appended to each chapter. —MCM

Chen, Albert T. F. *See* Olsen, Harold W. 05516

05014 **Cheng, Chao-nang.** Determination of amino acid-N in deep-sea sediments and the relationship between amino acid levels in three cores from the Argentine Basin and past climatic changes [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 936B-937B, 1969.

05401 **Cherdyntsev, V. V.; Kuptsov, V. M.; Zakrzyevskaya, I. V.** Osnovnyye zakonomernosti povedeniya izotopov tyazhelykh radielementov v aktivnom vulkanizme ostrova Gavayi: Akad. Nauk SSSR Doklady, v. 188, no. 2, p. 442-445, illus., table, 1969.

The U, Ra, and Pb-210 content and the ratios of the various radioactive isotopes in minerals and rocks recently erupted in Hawaii are tabulated. On the average, the U-234/U-238 and Ra/U are close to equilibrium values; Io/Th-232 ratios fluctuate more widely. The relative content of radiothorium is much less than the equilibrium value. The regional difference in the active volcanism of Hawaii compared to other regions seems to be a high Th/U ratio. The order of distribution according to degree of their transfer in volcanic exhalations is: U-238 = U-234>Io>Th-232 for the long-lived isotopes and MsTh > Ra > Pb(?) > Ac for the short-lived. – DBV

Chesser, S. *See* Hopkins, E. 05368

05354 **Chmelik, Frank B.; Bouma, Arnold H.; Rezak, Richard.** Comparison of electrical logs and physical parameters of marine-sediment cores [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2034, 1969.

05158 **Chrismas, L.; Baadsgaard, H.; Folinsbee, R. E.; Fritz, P.; Krouse, H. R.; Sasaki, A.** Rb/Sr,S, and O isotopic analyses indicating source and date of contact metasomatic copper deposits, Craigmont, British Columbia, Canada: Econ. Geology, v. 64, no. 5, p. 479-488, illus., tables, 1969.

K-feldspar veins give a Rb/Sr isochron of 200 ± 2 m.y., in good agreement with the K/Ar date of 198 ± 8 m.y. for the parent batholith. The low initial Sr-87/Sr-86 ratio, 0.7037 ± 0.0002, implies a mantle source for batholith and ore similar to that of recent basalt. Sulfur isotope data suggest that mantle-type sulfur became dominant over country-rock sulfur as mineralization progressed. Similarly C and O determinations indicate little or no magmatic C during early skarn formation, and a magmatic, non-limestone source for the carbonate associated with late mineralization. —WSW

05470 **Christensen, R. W.; Kim, J. S.** Rheological model studies in clay [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 17, no. 2, p. 83-93, illus., 1969.

Deformation in clays involves a combination of recoverable deformation, resulting from bending and rotation of individual particles, and irrecoverable deformation, treated as a rate process in which interparticle bonds are continually broken and reformed and governed by activation energy associated with rupture of bonds. In a rheological model, the fundamental element consists of a spring, representing recoverable deformation, in series with a rate process dashpot representing the irrecoverable. Owing to heterogeneous nature of the fabric, a wide range of material properties is anticipated and accounted for by assuming a Gaussian distribution for properties. The complete model consists of a combination of spring and dashpot elements covering the complete spectrum of properties. Model response is analyzed by computer for creep and constant strain-rate loading. Experimental data for triaxial tests on clays are compared with model behavior. — *from* Authors' abstract

05015 **Chu, Wen-kuan.** The adsorption of zinc by soil minerals [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 937B, 1969.

05047 **Churkin, Michael, Jr.; Brabb, Earl E.** Prudhoe Bay discovery forces a look at other Alaskan petroliferous areas: Oil and Gas Jour., v. 67, no. 46, p. 104-110, illus., table, 1969.

Complicated structure, scarcity of reservoir rocks, igneous activity, and other adverse factors make the Kandik basin of east-central Alaska less promising as a possible source of petroleum than previously reported. On the other hand, porous reeflike limestones of Paleozoic age and favorable structures make the area between the Kandik and Nation Rivers an attractive target for exploration. —WBC

Cincinnati University. *See* Indiana University. 05081

05214 **Circeo, L. J., Jr.** Nuclear excavation—Review and analysis: Eng. Geology, v. 3, no. 1, p. 5-59, illus., tables, 1969.

Nuclear excavation appears to be an economical, practical and beneficial use of nuclear explosives. Cratering technology can now make meaningfully predictions of crater and channel sizes in selected media, and continual research is underway in saturated, fine-grained, and stratified media, with advances in evaluation of potential hazards associated with underground detonation. The most apparent applications are to excavation of harbors, reservoirs, canals, and aggregate production. Nuclear excavation may alleviate potentially catastrophic situations resulting from floods, landslides and volcanoes. Its acceptance as a standard engineering tool depends upon the success of contained underground projects, and upon international cooperation in its peaceful uses. Significant cratering events are summarized in tabular form with their resultant phenomena. —GDC

05167 **Clark, Malcolm M.; Grantz, Arthur.** Geologic effects of the Borrego Mountain, southern California, earthquake of April 9, 1968 [abs.]: Earthquake Notes, v. 40, no. 2, p. 25-26, 1969.

Clark, Sydney P., Jr. *See* Turekian, Karl K. 05091

Clayton, R. N. *See* Syers, J. K. 05644

05454 **Cloud, P. E., Jr.; Semikhatov, M. A.** Proterozoic stromatolite zonation: Am. Jour. Sci., v. 267, no. 9, p. 1017-1061, illus., 1969.

The zonation of the Proterozoic of the USSR is reviewed and extension to other places is attempted. Preliminary results are: some of the columnar stromatolites of northern Eurasia occur in other continents and in the same stratigraphic ranges; some of the forms ("species") of the distinctive columnar types have intercontinental distribution, such as *Gruneria biwabikia* from Australia and North America. Pre-upper Proterozoic (pre-Riphean) strata also contain distinctive stromatolites of intercontinental distribution not known in younger strata, such as the new groups ("genera") *Gruneria* and *Katerina*. The above, together with progress in microbiota studies offers hope that at least a gross worldwide biological subdivision of Proterozoic will be practicable. The Belt Series seem to represent only one of the Soviet stromatolite zones. — *from* Authors' abstract

05137 **Cohen, Arthur David.** The petrology of some peats of southern Florida (with special reference to the origin of coal), V. 1-3 [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1196B, 1969.

05624 **Collins, D. H.** Devonian nautiloids from northern Canada [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 31-50, illus., 1969.

Three faunas of nautiloids are described from the northwestern mainland and the arctic islands. Five species from the type area of the Eids Formation on Ellesmere Island have elements in common with the Russian Eifelian. Two species from the Landry Formation of western District of Mackenzie are almost identical to species from the Eifel region of Germany. Collections from the Prongs Creek Formation of

the northern Yukon include *Leurocycloceras superplenum* n.sp. and two actinocerids that have internal structures intermediate between those of the Devonian Ormoceratidae and the Carboniferous Carbactinoceratidae. *Folioceras segmentum* n.gen., n.sp., is described from the Eids Formation. *Folioceras* is the only member of the Folioceratidae, a new family which has greatest affinity with the Orthocerida. — Author's abstract

05212 **Condie, Kent C.; Potts, Mark J.** Calc-alkaline volcanism and the thickness of the early Precambrian crust in North America: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1179-1184, illus., tables, 1969.

Geochemical and geophysical data indicate that the average potash content of young calc-alkaline volcanics increases in approximately a linear manner with crustal thickness. If such a relationship existed during the Precambrian, potash contents of early Precambrian (> 2.7 billion years) calc-alkaline volcanics in the Canadian Shield indicate that these volcanics were erupted onto a crust that was approximately 10-25 km thick. Since 3-13 km of these volcanics are now exposed, the total thickness of the early Precambrian crust prior to the Kenoran orogeny may have approached or reached present-day crustal thickness. — Authors' abstract

05355 **Conolly, John R.; Ewing, Maurice.** Redeposition of pelagic sediment by turbidity currents — A common process for building abyssal plains [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2034, 1969.

05594 **Conyers, E. S.; Wilding, L. P.; McLean, E. O.** Influence of chemical weathering on basal spacings of clay minerals: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 518-523, illus., table, 1969.

Five clays were weathered with H, HO^-, and H-resin; sodium tetraphenylboron + resin; and boiling nitric acid + resin treatments and subjected to X-ray analysis. Resin treatment caused only minor changes in clay structure; $NaBPh_4$ removed K from the 10A discrete and interstratified components, allowing them to expand to 14A; and HNO_3 reduced the interlayer K content of 10A components, particularly for the illite specimen, but did not reduce layer charge and/or interlayer K sufficiently to permit lattice expansion. In contrast, HNO_3 severely altered the basal structure of vermiculite converting a portion of it to an expanding lattice structure. Montmorillonite and kaolinite were not appreciably affected by any of the treatments. — Soil brief

Cook, G. *See* Sackett, W. M. 05331

05563 **Cook, Peter John.** The petrology and geochemistry of the Meade Peak Member of the Phosphoria Formation [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 707B, 1969.

05138 **Cooley, Richard Lewis.** The geohydrologic variables which control seepage from a stream crossing an alluvial fan [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1196B-1197B, 1969.

05285 **Cooper, J. A.; Rancitelli, L. A.; Perkins, R. W.; Haller, W. A.; Jackson, A. L.** An anticoincidence shielded Ge(Li) gamma-ray spectrometer and its application to neutron activation analysis, *in* Modern trends in activation analysis, V. 2 — Internat. Conf., Gaithersburg, Md., 1968, Proc.: U.S. Natl. Bur. Standards Spec. Pub. 312, v. 2, p. 1054-1061, illus., 1969.

An anticoincidence shielded Ge(Li) gamma-ray spectrometer is described which was designed to provide a high degree of Compton reduction as well as high efficiency and resolution. Its use in extending the applicability of nondestructive activation analysis is illustrated by results from proton activated basalt and neutron activated standard rock W-1. — VSN

Cooper, J. A. *See* Rancitelli, L. A. 05521

Cooper, James J. *See* Bauer, Herman L., Jr. 05576

05378 **Cooray, P. G.** Charnockites as metamorphic rocks: Am. Jour. Sci., v. 267, no. 8, p. 969-982, 1969.

In many areas, charnockites are intimately associated with metasediments belonging to granulite facies. Both have similar textures, common mineralogical characteristics and, in several instances, the same structural pattern. From these occurrences, it is proposed that charnockites *as they now occur* are themselves metamorphic. Some charnockites also contain relic orthopyroxene and are found with migmatized and granitized rocks, together with some scattered metasedimentary bands. These may be altered from an original granulite facies rock. Acidic charnockites, however, may occur as diffuse pegmatites, cross-cutting veins and dikes, and intrusive bodies, and may be the product of anatexis and palingenesis of original charnockites. — HRC

05248 **Cowen, Richard.** Les plaques stégidiales du Brachiopode jurassique *Spiriferina:* Soc. Géol. France Bull. 1968, ser. 7, v. 10, no. 4. p. 516-518, illus., 1969.

The stratigraphic and taxonomic distribution of the remarkable delthyrial structure, the stegidium, has been extended by the discovery in the last spiriferid Brachiopoda known, *Spiriferina*, from the lower Jurassic of western Europe. The discovery of this structure among the *Spiriferinacea* confirms the theory that this super family derived principally from the impunctate *Spiriferacea* rather than the punctate *Suessiacea*. — Author's abstract, GDC

05241 **Cracraft, Joel.** Systematics and evolution of the Gruiformes (Class,Aves) — [Pt.] 1, The Eocene Family Geranoididae and the early history of the Gruiformes: Am. Mus. Novitates, no. 2388, 41 p., illus., tables, 1969.

The relationships of some fossil gruiform birds from the Eocene of North America are reviewed. Two new genera are described and allocated to the Geranoididae. The Geranoididae are probably derived from a common ancestor with the Eogruidae of the Eocene of eastern Asia. The geranoidids are possibly ancestors of the Bathornithidae. — KAF

Cramer, Fritz H. *See* Andress, Noel E. 05341

Cramer, Fritz H. *See* Goldstein, Robert F. 05364

05456 **Crane, R. L.; Ehlers, E. G.** The system MgF_2-MgO-H_2O: Am. Jour. Sci., v. 267, no. 9, p. 1105-1111, illus., tables, 1969.

The phase relations in the system MgF_2-MgO-H_2O and the stability field of the compound Mg(OH)F were determined. Limited solid solution of Mg(OH)F in both MgF_2 and $Mg(OH)_2$ exists. — Authors' abstract

05267 **Cumming, G. L.; Robertson, D. K.** Isotopic composition of lead from the Pine Point deposit: Econ. Geology, v. 64, no. 7, p. 731-732, illus., table, 1969.

Preliminary lead-isotope ratios on nine samples from the Pine Point area are reported. The ratios are consistent within the experimental errors of about 25 percent and fall on the mantle growth curve. They indicate that the lead came from a homogeneous source with a model age of about 250-275 years, appreciably younger than the Devonian host rocks. — Authors' abstract

05088 **Currie, K. L.; Larochelle, A.** A paleomagnetic study of volcanic rocks from Mistastin Lake, Labrador, Canada: Earth and Planetary Sci. Letters, v. 6, no. 4, p. 309-315, illus., tables, 1969.

Paleomagnetic data are presented for unaltered and undisturbed volcanic rocks of apparent Upper Triassic age. The magnetization is stable and homogeneous, suggesting acquisition at the time of original cooling. Measurements from 73 cores yielded a mean direction of magnetization: declination, 179.9°, inclination -68.2°. A statistical analysis of the data indicate that mean directions of magnetization of the ten sites are significantly different. Their angular standard deviation is 4.4°, and the radius of the circle of confidence about the resultant is 2.4°. The virtual pole position is at 117.7°

E., 85.5° N. Good agreement between this and other published data suggests that the magnetic field was mainly dipolar during part of the Upper Triassic to Lower Jurassic, and that the radiometric date on the Mistastin Lake volcanic rocks (202 m.y.) may be slightly too old. —*from* Authors' abstract

05372 **Currie, K. L.** Reply [to discussion by T. Feininger (1969) *of* "On the solubility of albite in supercritical water in the range 400 to 600°C and 750 to 3500 bars", 1968]: Am. Jour. Sci., v. 267, no. 8, p. 1013-1014, 1969.

Feininger (ibid., p. 1011-1012), having made some supercritical remarks about the original work by Currie, is advised that some of the limited statements were made because of limiting data in the original experiments; other explanations are proffered for variations in the original text. Currie does not concur with Feininger's disagreement regarding the occurrence of barren quartz veins only in the greenschist facies. — HRC

05441 **Currie, K. L.** Geological notes on the Carswell circular structure, Saskatchewan (74K): Canada Geol. Survey Paper 67-32, 60 p., illus., tables, geol. map, 1969.

The structure comprises a nearly circular downdropped block 25 mi in diameter, set in undisturbed clastic rocks of the Athabasca Formation. Inside the block, Carswell dolomite is exposed in a marginal ring syncline, folded and deformed. The Athabasca, undeformed, is exposed in a ring between the Carswell and a central core of basement complex characterized by deformation lamellae on quartz and by local potash metasomatism and iron depletion. Both features are associated with fault zones containing lenticular masses of Cluff breccia. Origin by extraterrestrial impact is considered and rejected; the cause is considered to be diapirism of the basement caused by intrusion, or more probably, by concentration of volatiles at depth. The rising diapir dragged up the Athabasca along its flanks, and the Carswell domed over the diapir and then slid down the flanks. The last stage was marked by escape of volatiles. — *from* Author's abstract

05223 **Czamanske, Gerald K.** The stability of argentopyrite and sternbergite: Econ. Geology, v. 64, no. 4, p. 459-461, illus., table, 1969.

Because of inability to synthesize these two ternary polymorphs, heating experiments were carried out on natural crystals to determine their stabilities and to calculate approximate thermodynamic values. Both phases broke down completely after 30 days at 175°C, argentopyrite more quickly than sternbergite. The metastable breakdown assemblage argentite-pyrrhotite with minor pyrite anneals to the stable assemblage native silver-pyrite-pyrrhotite. Scarcity of the minerals results primarily from the very low sulfur fugacities required. —WSW

Dachille, Frank. *See* Gigl, Paul D. 05051

05560 **Daggett, Larry Leon.** An optimization technique for the development of a ground water management program [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 661B, 1969.

Dalrymple, G. B. *See* Fyfe, W. S. 05469

05533 **Dalziel, I. W. D.; Brown, J. M.; Warren, T. E.** The structural and metamorphic history of the rocks adjacent to the Grenville front near Sudbury, Ontario, and Mount Wright, Quebec, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 207-224, illus., tables, 1969.

Detailed structural studies on the Grenville front near Sudbury, Ontario, and a reconnaissance near Mount Wright, Quebec, south of the Labrador trough, indicate that high-grade metamorphism and regional migmatization characteristic of the western Grenville province were initiated very early in the structural history, probably in Hudsonian (Penokean) time. This hypothesis is in keeping with recently published data indicating metamorphism of certain paragneisses in the French River-Sudbury region before 1500 m.y. ago. Exact geological significance of widespread 800-1000

m.y. dates in the western Grenville province is not clear. Definition of orogenic episodes in the Canadian Shield on the basis of statistical analysis of K-Ar dates obtained from material collected with little structural control seems ill-advised. — *from* Authors' abstract

Damberger, H. H. *See* Peppers, R. A. 05219

D'Amico, J. *See* McCorkell, R. H. 05050

Date, R. *See* deLaeter, J. R. 05464

05398 **Davey, Roger Jack.** Non-calcareous microplankton from the Cenomanian of England, northern France, and North America, Pt. 1: British Mus. (Nat. History) Bull., Geology, v. 17, no. 3, p. 105-180, illus., 1969.

This paper, in two parts, describes some Upper Cretaceous microplankton assemblages and evaluates them for stratigraphic correlation. In Pt. 1, resting cysts of dinoflagellates — a total of about 74 species and varieties, 16 new, in 29 genera, 3 new — are described from localities in England, France, Saskatchewan, and Texas. The Saskatchewan samples, from a borehole east of Regina (Colorado Group), yielded 12 genera and 18 species, 4 new: *Gonyaulacysta delicata, ?Cleistosphaeridium aciculare, Cyclonephelium eisenacki, Cribroperidinium intricatum,* the first three restricted to this locality; 13 of the species and all the genera are found also in Europe. The Tarrant County, Texas samples (upper Woodbine-lower Eagle Ford), yielded 5 genera and 8 species, all found also in Europe but only 3 genera and 3 species found also in Saskatchewan. — VMJ

05271 **Davies, R. D.; Herglotz, H. K.** A total reflection X-ray spectrograph for fluorescent analysis of light elements, *in* Advances in X-ray analysis, V. 12 — Applications of X-ray Analysis, 17th Ann. Conf., Denver, Colo., 1968, Proc.: New York, Plenum Press, p. 496-503, illus.; discussion, p. 503-505, 1969.

A novel X-ray spectrograph for analysis of light elements has been developed. Major components of the instrument are an efficient fluorescent source, a totally reflecting mirror, and an open window photomultiplier. Identification of wavelengths in the range $15 < \lambda < 80$ A is achieved by wavelength dependence of the critical angle of reflection of an X-ray beam incident on a suitably chosen low absorption reflector. As the incident angle is increased through the critical angle for a particular wavelength, reflected beam intensity is sharply reduced; hence, a periodic vibration of the incident beam through a small angular range about the critical angle furnishes a strong a.c. reflected signal characteristic of one narrow wavelength band only. Initial results promise a simple, easy-to-operate instrument for routine analysis of elements boron to fluorine. — *from* Authors' abstract

Davis, G. L. *See* Krogh, T. E. 05531

05373 **Davis, J. B.** Distribution of naphthenic acids in an oil-bearing aquifer: Chem. Geology, v. 5, no. 2, p. 89-97, illus., tables, 1969.

Organic fractions of artesian well waters from the oil-bearing Carrizo Formation, Atascosa County, Tex., were examined by infrared and chromatographic methods. A hexane-soluble naphthenic acid was extracted from ground waters of the formation. Water coproduced with the oil contains over 1000 times as much of the acid fraction as is found in the water updip of the oil. Water downdip of the oil contains five times as much as is found updip, and the downdip fraction is more similar to the coproduced water acids. An acid fraction is detectable in extracts of geologic formations associated with the Carrizo aquifer, and a phthalic acid ester is also present which is dissolved in the Carrizo water and may be common to ground waters, but apparently has not accumulated with oil in the Carrizo. — *from* Author's abstract

05215 **Davis, Margaret B.** Climatic changes in southern Connecticut recorded by pollen deposition at Rogers Lake: Ecology, v. 50, no. 3, p. 409-422, illus., tables, 1969.

Rates of deposition of pollen grains throughout late-glacial and postglacial time were determined from pollen concentration in radiocarbon-dated sediments. Changes by a factor of 5 or more for all but rare pollen types were considered significant in reflecting changes in productivity. Low rates reflect prevalence of tundra vegetation between 14,000 and 12,000 years ago. Increase in the rate for tree pollen 12,000 years ago indicates boreal woodland. A sudden sharp rise for white pine, hemlock, poplar, oak, and maple 9,000 years ago indicates forest, perhaps like that of northern Great Lakes region today. Pine pollen declined and ragweed pollen was high 8,000 years ago, corresponding to the prairie period of the Great Lakes region. Only during the past 2,000 years have pollen assemblages been comparable to modern ones in this area. —VMJ

05070 **Davis, Ronald B.; Doyle, Roger W.** A piston corer for upper sediment in lakes: Limnology and Oceanography, v. 14, no. 4, p. 643-648, illus., 1969.

A portable piston corer is described that takes nearly undisturbed cores of the upper meter of lake sediment and preserves the sediment-water interface. Upon signal through the two-conductor electric cable, when the corer has reached sampling depth, a weighted coring tube, surrounding the stationary piston, is released to descend slowly and smoothly into the sediment. It does not require preliminary depth sounding and can take cores at water depths of at least 60 m. Relative advantages and disadvantages of other corers are evaluated. —VMJ

Dawson, Mary R. *See* Stevens, Margaret S. 05667

05625 **Dean, W. T.** An occurrence of the Trilobite *Dechenella* (*Dechenella*) in the Middle Devonian Landry Formation, western District of Mackenzie [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 51-53, illus., 1969.

A single pygidium is described from rock matrix adhering to the Eifelian nautiloid *Rutoceras, ?eifelense* (d'Archiac and de Verneuil). – Author's abstract

DeFazio, T. *See* Reasenberg, P. 05181

05464 **deLaeter, J. R.; Abercrombie, I. D.; Date, R.** Mass spectrometric isotope dilution analyses of barium in standard rocks: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 64-66, tables, 1969.

The six new U.S.G.S. standard rocks, W-1 and the new S.S.C. syenite rock standards SY-2 and SY-3, have been analyzed for barium by the stable isotope dilution technique. Our recommended results are, in general, lower than the previously reported data. — Authors' abstract

Delavault, Robert E. *See* Warren, Harry V. 05236

05121 **Derr, John Sebring.** Internal structure of the Earth inferred from free oscillations [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1209B, 1969.

05648 **deVilliers, J. M.** Pedosesquioxides — Composition and colloidal interactions in soil genesis during the Quaternary: Soil Sci., v. 107, no. 6, p. 454-461, illus., 1969.

The author presents evidence for the occurrence of a discrete amorphous alumina, in certain soils, which may have a boehmitic character. The formation of amorphous alumina retards or inhibits crystallization of sesquioxides. The Natal soil is used as an example of this colloidal interaction. — JWH

05632 **deWaard, D.** Notes on P-T conditions of metamorphism in the Adirondacks: Empire State Geogram, v. 7, nos. 1-3, p. 16-17, 1969.

In reply to Buddington's comments (ibid., p. 7-17), deWaard notes that estimates of the P-T conditions are only as good as experimental data used, not all of which agree with each other. deWaard's (1967) estimates are not of actual temperatures, but of

minimum temperatures. The P_f of 1,700 bars is not proposed but happens to be the P_f at the minimum temperature. Intersections of melting curves and dehydration reactions were used to come to minimum temperatures. It is agreed with earlier authors that anatexis did take place in the Adirondack Lowlands, and that migmatites are at least partly of the venitic type. In the Highlands, migmatites of anatectic origin are widespread and are of nebulitic, dictyonitic, and crocyditic types, in contrast to the layered and veined types in the Lowlands. Some new data available since the 1967 paper are discussed, including the minimum temperature indicated by the presence of sillimanite. — ESL

05381 **deWaard, Dirk.** The occurrence of charnockite in the Adirondacks — A note on the origin and definition of charnockite: Am. Jour. Sci., v. 267, no. 8, p. 983-987, table, 1969.

These charnockites occur in two ways: as layers of metavolcanics or metasediments in a folded stratigraphic sequence of supracrustal rocks and as more homogeneous masses in the basement below the supracrustal sequence. In the latter case, they may have been derived from plutonic granite or from charnockite forming part of the magmatic anorthosite-charnockite suite. Magmatic charnockite is represented in the Adirondacks by the metatect of crocyditic and dictyonitic migmatites which occur locally in metamorphic charnockite. Hence, charnockite is formed by metamorphism of rocks of granitic bulk composition under granulite-facies conditions, and by crystallization from an anatectic melt or differentiated magma under granulite-facies conditions. Charnockite is defined as most commonly a metamorphic but also a magmatic rock that has the bulk composition of granite, and contains orthopyroxene and perthitic feldspar. — *from* Author's abstract

05122 **Dias, Carlos Alberto.** A non-grounded method for measuring electrical induced polarization and conductivity [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1209B, 1969.

Dickau, Bruce E. *See* Puri, Harbans S. 05324

05356 **Dickinson, Kendell A.** Upper Jurassic carbonate rocks in northeastern Texas and adjoining parts of Arkansas and Louisiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2034-2035, 1969.

05651 **Diesen, Carl E.** A nationwide computing network: Sci. and Technology, no. 93, p. 25-29, illus., 1969.

A nationwide system of computers is helping scientists and engineers of the U.S. Geological Survey to find answers to a wide spectrum of problems. A teleprocessing system built around a large-scale computer in Washington, D.C., is linked to smaller satellite computers in Survey field offices as send-and-receive terminals for data to-and-from the central computer. The diversity of applications reflects the far-reaching scope of Geological Survey activities in Divisions of Geology, Topographic Mapping, Water Resources, and Conservation. Previous use of different makes and models of computers created situations where identical problems were separately programmed in field locations, for systems inadequate to handle massive processing requirements. The core of the new system, Model 65, has a wide range of capability. Typical users are cited. — GDC

05564 **Dieterich, James Herbert.** Sequence and mechanics of folding in the area of New Haven, Naugatuck and Westport, Connecticut [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 708B, 1969.

Dillinger, William H. *See* Harding, Samuel T. 05182

05653 **Dion, N. P.** Hydrologic reconnaissance of the Bear River basin in southeastern Idaho: Idaho Dept. Reclamation Water Inf. Bull. 13, 66 p., illus., tables, geol. map, 1969.

In the Bear River basin ground water occurs in alluvium of valleys, basalt of Soda Creek basin and Gem Valley, Salt Lake Formation, fractured bedrock, and possibly in the Wasatch Formation. Basalt and alluvium, the most productive aquifers, are best able to withstand additional ground-water development; basalt is reported to yield as much as 3,500 gpm and alluvium 2,500 gpm to wells. While many wells drilled in the Salt Lake Formation are nonproductive, those successful yield as much as 1,800 gpm. Because few wells have been drilled into either the Wasatch or the undifferentiated bedrock, their yield capability is unknown. Ground-water contours indicate the Bear River between Alexander and Grace is a source of recharge to the ground-water reservoir. Ground waters are predominantly calcium and magnesium bicarbonate type; hundreds of springs discharge water of several chemical types. — *from* Author's abstract

05097 **Dionne, Jean-Claude.** Tidal flat erosion by ice at La Pocatière, St. Lawrence Estuary: Jour. Sed. Petrology, v. 39, no. 3, p. 1174-1181, illus., 1969.

The tidal flat areas of the Middle St. Lawrence Estuary are severely eroded by shore ice. Grooves parallel or perpendicular to the shoreline, measuring 30 to 80 cm wide, 20 to 35 cm deep, and 1500 to 2000 m long, and circular or subcircular basins up to 2 m in diameter and 20 to 40 cm deep are produced every spring by ice blocks that plough the surface and gradually disturb the sediments. —Author's abstract

05491 **Dodd, R. T.** Petrofabric analysis of a large microporphyritic chondrule in the Parnallee meteorite: Mineralog. Mag., v. 37, no. 286, p. 230-237, illus., 1969.

Olivine microphenocrysts in a large microporphyritic chondrule in the Parnallee chondrite show a linear preferred orientation of the long ($\beta = c$) axes, which is thought to reflect flowage of a partly crystalline parent magma. The orientation pattern is somewhat disturbed by postcrystallization fracturing. — Author's summary

05448 **Doelling, Hellmut H.** Mineral resources, San Juan County, Utah, and adjacent areas — Pt. 2, Uranium and other metals in sedimentary host rocks: Utah Geol. and Mineralog. Survey Spec. Studies 24, pt. 2, 64 p., illus., tables, 1969.

Uranium economics in the past, present, and future and the use of water in mining are reviewed. Factors in the further expansion of uranium in the area are listed and discussed in detail. Seventeen Pennsylvanian-Cretaceous formations and the mineralization of each are described. The relation of geologic structure to uranium deposits is examined. Characteristics are given of principal host rocks, Cutler, Chinle, and Morrison, and associated uranium. The last 30 pages are devoted to descriptions of the uranium districts and areas in the San Juan area. A map summarizing this information accompanies the report, and maps showing tectonic divisions and uranium occurrences are included. — ESL

05139 **Dolliver, Claire Vincent.** Late Tertiary and Quaternary geomorphic history of Kyle Canyon, Spring Mountains, Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1197B, 1969.

05525 **Douglas, Robert J. W.** Orogeny, basement and the geological map of Canada, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 1-6, illus., 1969.

The basis for the legend of the new geologic map of Canada is discussed, with appraisal of current understanding of age relations within and between major structural units. Principal geologic parameters used are: age, facies, structure, and metamorphism. Rocks are categorized according to standards of depositional age and orogenic age. For the Phanerozoic, depositional age is represented by a paleontological standard, with orogenic age referred to this standard. For the Precambrian, ages of depositional sequences are determined relative to radiometric dates of preceding and succeeding orogenies. Effects of an orogeny on the geosynclinal sequence, and those on the basement, are considered. Metamorphism changes the actual age of rocks only where they have acquired a new structural identity. — VMJ

Doveton, J. D. H. *See* Parsley, A. J. 05266

05202 **Dowling, John J.** Uncertainty in seismic refraction determined velocities [abs.]: Earthquake Notes, v. 40, no. 2, p. 7, 1969.

Doyle, Larry J. *See* Pilkey, Orrin H. 05323

Doyle, Roger W. *See* Davis, Ronald B. 05070

Duane, David B. *See* Meisburger, Edward P. 05319

05393 **DuBar, Jules R.** Biostratigraphic significance of Neogene macrofossils from two dug ponds, Horry County, South Carolina: South Carolina Div. Geology Geol. Notes, v. 13, no. 3, p. 67-80, illus., tables, 1969.

Four formations have been delineated in this area of flats behind the Conway Barrier: Peedee (Cretaceous), Bear Bluff (Pliocene,), Waccamaw (Aftonian,), and Conway (Pleistocene). Fossils in spoil piles at the dug ponds, 23 miles apart, appear to have their source in the Waccamaw, its top about 5 feet below ground surface. Mollusks predominate in both total invertebrate assemblages, but greater species diversity is at Simpson Creek than at the Brownway site. Both assemblages indicate water temperature similar to that off the present east coast of south-central Florida; species indicate an open ocean, shallow shelf environment at Simpson Creek, estuarine at Brownway. The fossils, apparently buried *in situ*, suggested an early Pleistocene rather than Pliocene age for the Waccamaw Formation. — GDC

05129 **Dunlap, William Howard.** Compaction of an unsaturated soil under a general state of stress [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1091B, 1969.

05552 **Dunlop, David John.** The remanent magnetism of rocks containing interacting single domain ferromagnetic grains [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 715B, 1969.

05304 **Dyck, Willy.** Development of uranium exploration methods using radon: Canada Geol. Survey Paper 69-46, 26 p., illus., tables, 1969.

Results are given of tests in surface waters and soils in 1968 to determine applicability of the radon method for uranium prospecting. In Gatineau Hills, Quebec, results suggest that surface and underground water drainage is responsible for radon and radium in the lake systems; soil emanations outline radioactive pegmatites. A radon anomaly in surface waters of the eastern quarter of Sudbury irruptive appears to be similar in origin to those in Gatineau Hills. In the Elliot Lake area two lakes in contaminated channels and two in uncontaminated terrain overlying the uranium-bearing Matinenda Formation were studied. Results from contaminated lakes demonstrate principles of radon prospecting well. Radon levels in the uncontaminated lakes are a factor of ten lower than the contaminated. The radon method can outline radioactive sources on a reconnaissance as well as a detailed scale. — *from* Author's abstract

Echels, D. J. *See* Levin, H. L. 05450

05140 **Edgar, Norman Terence.** Seismic refraction and reflection in the Caribbean Sea [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1197B, 1969.

05076 **Edge, R. A.; Taylor, H. F. W.** Crystal structure of thaumasite, a mineral containing $[Si(OH)_2]^{2-}$ groups: Nature, v. 224, no. 5217, p. 363-364, 1969.

The crystal structure of thaumasite was determined from measurements of 375 independent X-ray reflections, using a crystal from Paterson, New Jersey. The results are interesting because they show the presence of ions with six-coordination of silicon by hydroxyl. The idealized constitutional formula is given. The structure closely resembles that of ettringite. —DBV

Eggert, Donald A. *See* Taylor, Thomas N. 05506

05538 **Eggert, Donald A.; Kryder, Ralph W.** A new species of *Aulacotheca* (Pteridospermales) from the Middle Pennsylvanian of Iowa: Palaeontology, v. 12, pt. 3, p. 414-419, illus., 1969.

Aulacotheca iowensis sp. nov., is described from the Middle Pennsylvanian of Iowa; it is distinct from previously described forms in synangial dimensions, number of sporangia per synangium, and size range of pollen grains. The Iowa material demonstrates that pollen organs of the *Aulacotheca* type were borne in large numbers on ultimate axes of either an entirely fertile frond or portion of frond lacking planated foliar structures. Orientation of the synangia suggests that the fertile regions were three-dimensional and bushy prior to fossilization. — Authors' abstract

Ehlers, E. G. *See* Crane, R. L. 05456

Ehmann, W. D. *See* Morgan, J. W. 05487

05396 **Ehrlich, M.; Sun, S.; Scharon, L. H.; Soffel, H. C.** Magnetic and palaeomagnetic investigations of the Precambrian Iron Mountain deposits, southeast Missouri: Inst. Mining and Metallurgy Trans., v. 78, Bull. 753, p. B114-B122, illus., tables, 1969.

Magnetic measurements of subsurface samples from the Precambrian Iron Mountain, Missouri, orebody indicate that within the orebody only hematite and hematite-bearing andesitic material with <2 percent magnetite by volume have stable natural remanent magnetization and exhibit remanence direction indicative of a Precambrian age without demagnetization cleaning. Hematite with <2 percent magnetite yields a virtual geomagnetic pole position at 138° W., 34° S.; that with >2 percent magnetite yields a pole at 133° W., 4° S. The higher magnetite ore is adjacent to dikes and was probably formed during intrusion by reduction of hematite; therefore, a possible movement of 30° by the pole between time of ore deposition and dike intrusion is suggested. — VSN

05489 **Ehrreich, A. L.; Winchell, R. E.** Rapakivi texture in rhyolite: Nature, v. 224, no. 5222, p. 904-905, 1969.

This paper describes briefly a notable example of a volcanic body with rapakivi texture, a Miocene rhyolite exposed near California State Highway 178 on the east flank of Rhodes Hill, 1/4 mile west of the eastern boundary of Death Valley National Monument. Significant in determining the origin of the rapakivi texture are (1) incomplete unmixing of the feldspars; (2) evidence of vesiculation during formation of the rapakivi texture; (3) mantled and unmantled sanidine; (4) at least two stages of formation of hydroxyl-bearing minerals; and (5) coexistence of ovoidal and euhedral grains of sanidine, plagioclase, and quartz. — DBV

05224 **Eisbacher, Gerhard H.** Displacement and stress field along part of the Cobequid Fault, Nova Scotia: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1095-1104, illus., 1969.

The east-trending Cobequid Fault separates pre-Carboniferous rocks of the Cobequid Mountains to the north from Carboniferous clastic rocks along the southern flank of the mountains. A detailed study of the fault zone revealed the predominance of right-lateral displacements. The orientation of the stress field that existed during deformation along the fault trace was determined by the study of systematic fractures in pebbles within Carboniferous conglomerate. Maximum compressive stress was aligned in a NW-SE direction, being compatible with the orientation of the displacement vectors in the fault zone. Transcurrent movement along the Cobequid Fault occurred in late Pennsylvanian time and involved both Carboniferous and pre-Carboniferous rocks; total displacement is unknown. —Author's abstract

El-Badry, H. M. *See* Ostic, R. G. 05471

05130 **El-Domiaty, Awatif Mohammed.** Stress-strain characteristics of a saturated clay soil at various strain rates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1091B-1092B, 1969.

Elliott, James E. *See* Wells, John D. 05301

Ellis, Michael J. *See* Adolphson, Donald G. 05247

05387 **Ellison, B. E.** Water in Mississippi: Jackson, Miss., Mississippi Board Water Commissioners, 51 p., illus., 1969.

This report is designed to meet the needs of school children who frequently request information about Mississippi's water resources. A brief insight into the importance of water is presented to acquaint the young reader with some of the means by which water studies are made by Federal and Stage agencies. It is not intended to answer technical questions. — *from* preface

05357 **Elsik, William C.** Late Neogene palynomorphs diagrams, northern Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2035, 1969.

05141 **Elwell, James Halsey.** Deterioration zone petrology of selected highway concretes [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1197B-1198B, 1969.

Engen, Gladys R. *See* Brune, James N. 05191

05565 **Erikson, Erik Harold, Jr.** Petrology of the composite Snoqualmie batholith, central Cascade Mountains, Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 708B, 1969.

05607 **Ernst, W. G.** Earth materials: Englewood Cliffs, N. J., Prentice-Hall, Inc., 150 p., illus., tables, 1969.

An understanding of processes whereby rocks and minerals form is fundamental to an appreciation of the Earth and its origin. This short book provides a lengthier and more quantitative approach to the study of minerals and rocks than is found in conventional elementary texts, but is much shorter than mineralogy and petrology books currently employed in second year courses. Topics in mineralogy are based on fundamentals of atomic and crystal structure, which introduces certain basic principles of thermodynamics and physical chemistry. Emphasis in petrologic discussions is on mineral assemblages and their aggregate stability relations. Chapter headings are: mineralogy and crystal chemistry, petrochemistry, mineralogy of nonsilicates, mineralogy of silicates, igneous rocks, sedimentary rocks, and metamorphic rocks. — MCM

Estes, Ernest L. *See* Pilkey, Orrin H. 05323

05511 **Estes, Richard.** A new fossil discoglossid frog from Montana and Wyoming: Breviora, no. 328, 7 p., illus., 1969.

Scotiophryne pustulosa, n. gen., n.sp., is a small discoglossid frog from the late Cretaceous Hell Creek Formation of Montana and the late Cretaceous Lance Formation of Wyoming. It is probably also represented in the middle Paleocene Tongue River Formation of Montana. *Scotiophryne* has a distinctive pustular dermal skull, but its postcranial remains show resemblances to the Recent Eurasian discoglossid *Bombina*. — Author's abstract

05512 **Estes, Richard; Berberian, Paul.** *Amia* (= *Kindleia*) *fragosa* (Jordan), a Cretaceous amiid fish, with notes on related European forms: Breviora, no. 329, 14 p., illus., table, 1969.

Numerous well-preserved disarticulated specimens from the late Cretaceous Hell Creek Formation of Montana show that *Kindleia fragosa* Jordan, a late Cretaceous to middle Eocene amiid from North America, is referable to the Recent genus *Amia*. *A. fragosa* resembles the middle Eocene *A. gurleyi* from North America, the late Paleocene *A. russelli* from France, the middle Eocene *A. kehreri* from Germany, and the Oligocene *A. munieri* from France in a number of minor but consistent skull features. Most differences from the living *A. calva* shown by the fossil forms are minor

and probably primitive. These morphological differences, and close relationship of Cretaceous seas of the western interior to the Mississippi River drainage of today, indicate that *A. fragosa* is not far from the ancestry of *A. calva*. — *from* Authors' abstract

05513 **Estes, Richard.** A scincoid lizard from the Cretaceous and Paleocene of Montana: Breviora, no. 331, 9 p., illus., 1969.

Contogenys sloani, n. sp., is a scincoid lizard from the late Cretaceous Hell Creek Formation and middle Paleocene Tongue River Formation of [eastern] Montana. Its closest relationships seem to be with primitive members of the Scincidae, and it is tentatively referred to that family. *Contogenys* is specialized in possession of short mandibles with the posterior teeth diminishing little in size relative to anterior ones. — Author's abstract

Eugster, H. P. *See* Bradley, W. H. 05164

Evans, A. G. *See* Reinig, W. C. 05284

05299 **Ewers, W. E.** Hydrothermal transport and deposition of gold [discussion of paper by Helgeson and Garrels, 1968]: Econ. Geology, v. 64, no. 5, p. 575, 1969.

Diffusion along a temperature gradient and convection within the vein system may reduce the improbably large volume of water implied by the Garrels and Helgeson model (ibid., v. 63, p. 622-635, 1968). —WSW

Ewing, Maurice. *See* Conolly, John R. 05355

Eyl, B. *See* Bonatti, E. 05349

Fagan, James M. *See* Carpenter, Robert H. 05230

05358 **Fagg, Clint F.; Herlihy, Daniel E.** Profile analysis — A geologically oriented gravity interpretation [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2035, 1969.

05541 **Fairbridge, R. W.** On the absolute fall of sea-level during the Quaternary — A discussion [of paper by J. W. Holmes, 1969]: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 6, no. 3, p. 241-242, 1969.

Some exceptions are made to the paper by Holmes [ibid., p. 237-239], especially to the classic error, "the Tertiary was characteristically warmer and more arid" than the Quaternary; considerable evidence is cited to the contrary. The sharp climatic oscillations during the Quaternary resulted in repeated migrations of the climatic belts and in the midlatitudes the shift from interglacial to glacial maximum could have been catastrophic. The dying vegetation exposed the soil to intense gullying and erosion was largely mechanical, not chemical. — HRC

05443 **Falconer, Allan.** Processes acting to produce glacial detritus: Earth Sci. Jour., v. 3, no. 1, p. 40-43, 1969.

The traditional view of attrition and abrasion as the major agents producing glacial debris is considered in the light of recent work by engineering geologists and geomorphologists. The decomposition of certain rock types when affected by frost action leads to the concept of rock deterioration within the body of the glacier. It seems that differing rock types with varying responses to low temperature conditions would produce a heterogeneous mixture of particle size such as is usually termed glacial till. Observations in recent work on rock stability emphasize the importance of clay minerals and their mode of occurrence. It is considered that a detailed study of the stability of rocks forming the source region of a glacier should give considerable insight into the nature of the till produced. — Author's abstract

05371 **Feininger, Tomas.** Discussion — "On the solubility of albite in supercritical water in the range 400 to 600°C and 750 to 3500 bars" [by K. L. Currie, 1968]: Am. Jour. Sci., v. 267, no. 8, p. 1011-1012, 1969.

Errors of omission and commission in the original article (ibid., v. 266, p. 321-341, 1968) are discussed. Starting points for some of the graphs of the soda to potash ratio are unclear, and some figures regarding leaching of all of the potash from some of the samples seem inaccurate. Further, some of Currie's geological conclusions interpreted from his analytical data are open to challenge. Feininger believes that obscure presentation and editorial lapses further mar the paper. — HRC

Ferguson, Hershal C., Jr. *See* Levert, Charles F., Jr. 05339

05586 **Ferrusquia-Villafranca, Ismael; Wood, Albert E.** New fossil rodents from the early Oligocene Rancho Gaitan local fauna, northeastern Chihuahua, Mexico: Texas Memorial Mus. Pearce-Sellards Ser., no. 16, 13 p., illus., tables, 1969.

One new genus and three new species of rodents are described from the early Oligocene of Chihuahua. *Mytonomys gaitamia* is a paramyid slightly more advanced than species from the late Eocene of Utah and California. *Jaywilsonomys*, new genus with two new species, [type species *ojinagaensis*, and *pintoensis*] is a cylindrodont apparently descended from the late Eocene *Pareumys*. The Chihuahua deposits are probably slightly later than the late Eocene Myton of Utah and probably appreciably earlier than the early Oligocene Capote Mountain Tuff of Trans-Pecos Texas. — Authors' abstract

05142 **Fiero, G. William, Jr.** Ground-water systems of central Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1198B, 1969.

Fireman, E. L. *See* McCorkell, R. H. 05050

05647 **Flach, K. W.; Nettleton, W. D.; Gile, L. H.; Cady, J. G.** Pedocementation — Induration by silica, carbonates, and sesquioxides in the Quaternary: Soil Sci., v. 107, no. 6, p. 442-453, illus., tables, 1969.

The authors summarize evidence that opal-like silica compounds, calcium carbonate, and sesquioxides with and without organic matter are responsible for the formation of cemented soil horizons. The mechanisms by which these three materials bring about cementation are not identical. — JWH

Folinsbee, R. E. *See* Chrismas, L. 05158

Folinsbee, R. E. *See* Jackson, S. A. 05238

05039 **Force, L. M.** Calcium carbonate size distribution on the west Florida shelf and experimental studies on the microarchitectural control of skeletal breakdown: Jour. Sed. Petrology, v. 39, no. 3, p. 02-934, illus., tables, 1969.

Mollusks tend to break down mechanically into three basic microarchitectural units: layers (500-250μ), sublayers (32-4μ), and unit crystals (0.5-.125μ). In natural environments the size distribution of carbonate in sediments differs from that produced artificially because of selective dispersal by waves and tidal currents. In the inner continental shelf off west Florida, the particles smaller than 500μ, produced mainly in the wave zone, tend to accumulate on the outer shelf and in the lagoons. The breaker zone contains most of the coarser particles. —*Author's abstract*

05434 **Forrest, J. B.; MacFarlane, I. C.** Field studies of response of peat to plate loading: Am. Soc. Civil Engineers Proc., v. 95, paper 6652, Jour. Soil Mechanics and Found. Div., no. SM4, p. 948-967, illus., 1969.

Results are presented of small-scale field tests near Ottawa, to investigate in situ deformational characteristics of a soft peat, particularly near a load discontinuity. A 3-ft diameter plate applied loads to the surface of a 10-ft thick stratum of nonwoody

fine fibrous peat with a moisture content of about 950 percent. Rates and magnitude of settlement, and pore pressures at five positions were measured and compared. Supplementary data were obtained from a limited number of odometer-type laboratory consolidation tests, with and without pore pressure measurements. The geometry of the settlement-logarithmic time plots is described. Emphasis is on prevalence of horizontal drainage and its significance. The departure of soft organic materials from predicted behavior as based upon the linear theory of elasticity is described, with possible reasons for lack of agreement. — *from* ASCE abstract

05153 **Fortescue, J. A. C.; Usik, Lily.** A biogeochemical investigation at Mer Bleue bog, Sec. H *in* Progress report on biogeochemical research at the Geological Survey of Canada, 1963-1966: Canada Geol. Survey Paper 67-23, pt. 2, p. 95-101, illus., 1969.

The results of the biogeochemical investigation at Mer Bleue bog demonstrated that using a relatively simple sampling method it was possible to obtain vertical distribution patterns for several elements in the peat of a bog unassociated with any known mineralization. When one considers the relatively few samples used and the low density of sampling (10 profiles at 200-ft intervals) it is interesting to note that similar distribution patterns for different combinations of elements were obtained. It may be concluded that the procedures described for the collection, preparation, and analysis of peat are suitable for preliminary biogeochemical prospecting research of peat bogs in the vicinity of known, undisturbed mineral deposits. — Authors' summary

05160 **Fortescue, J. A. C.; Usik, Lily.** Geobotanical and soil geochemical investigations during 'Visits' to eight landscapes with undisturbed mineral deposits, Sec. E *in* Progress report on biogeochemical research at the Geological Survey of Canada, 1963-1966: Canada Geol. Survey Paper 67-23, pt. 2, p. 10-38, illus., tables, 1969.

Geobotanical investigations made at two drilled undisturbed mineral deposits resulted in the establishment of plant-cover type mapping methods, and methods of plant species collection and identification. The Hambone Lake nickel deposit site near Thompson, Manitoba, offered opportunity for experience in geobotanical mapping procedures. The presence of boulder clay and lacustrine clays in surficial materials restricted the research program. At the Huckleberry Mountain copper deposit, British Columbia, a plant-cover map was made and a Pilot Project was planned. Plant species in both areas are tabulated. Soil geochemical investigations near mineral deposits are described and results from eight sites summarized. —ESL

05161 **Fortescue, J. A. C.; Hornbrook, E. H. W.** Two quick projects, one at a massive sulphide orebody near Timmins, Ontario and the other at a copper deposit in Gaspé Park, Quebec, Sec. F *in* Progress report on biogeochemical research at the Geological Survey of Canada, 1963-1966: Canada Geol. Survey Paper 67-23, pt. 2, p. 39-63, illus., table, 1969.

The Kidd Creek orebody was exceptionally favorable for geochemical prospecting research in the Great Clay Belt of northern Ontario, because, although the ore does not outcrop, the ore zone is large and suboutcrops over a large area under a thin cover. Strong anomalies for zinc and copper were found in the coarse-textured lower till above the orebody and down-ice from it, with negative results in overlying layers of varved clays. At the Pekan Creek property in Gaspé Park, Quebec, samples of mineral and organic soils, and material from balsam firs were collected and analyzed by colorimetric methods and the total copper, zinc, lead, and nickel content obtained. Results have been brought together on a scan sheet. It was concluded that the B horizon of the soil is a reliable guide. The reasons for failure to find anomalies in organic materials are not known. —ESL

Foster, Robert L. *See* Chapman, Robert M. 05209

Franck, J. *See* Muxart, R. 05463

05026 **Franklin, J. A.** Rock impregnation trials using monomers, epoxide, and unsaturated polyester resins: Jour. Sed. Petrology, v. 39, no. 3, p. 1251-1253, table, 1969.

Impregnation of very small pores and cracks in large specimens calls for the impregnating materials of the maximum fluidity. Recent trials showed that monomeric types of impregnating material give considerably better penetration than the epoxides and polyesters usually used for this purpose. The monomers and their resulting polymers have, however, certain disadvantages compared with the more standard impregnating media. The advantages and problems associated with monomer impregnation are discussed and details are given of a simple impregnation technique employing the monomer styrene. —Author's abstract

05019 **Frazee, Charles Joseph.** Distribution of loess from a source [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 941B-942B, 1969.

05359 **Frazier, David E.** Depositional episodes — Their relation to Quaternary sea-level fluctuations in Gulf Coast region [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2035-2036, 1969.

French, Robert R. *See* Rooney, Lawrence F. 05013

05360 **Frey, M. G.; Grimes, W. H.** Bay Marchand-Timbalier Bay-Caillou Island salt complex, Louisiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2036, 1969.

05361 **Frey, Robert W.; Howard, James D.** Profile of biogenic sedimentary structures in Holocene barrier island-salt marsh complex, Georgia [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2036, 1969.

05143 **Frey, Robert Wayne.** Stratigraphy, ichnology, and paleoecology of the Fort Hays Limestone Member of the Niobrara Chalk (Upper Cretaceous) in Trego County, Kansas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1198B, 1969.

05031 **Friedman, Gerald M.; Kumar, Naresh.** Procedure for shipboard measurement of pH and Eh in sediment cores within plastic liners: Jour. Sed. Petrology, v. 39, no. 3, p. 1247-1249, illus., 1969.

Previously described shipboard methods for measuring pH and Eh in cores have involved extrusion of the cores. A technique has been developed measuring pH and Eh of sediment cores inside a plastic liner. After the top of the core has been sealed, points of measurement are marked on the outside of the liner. At each point, a hole large enough to insert the electrode is drilled. By drilling the first hole at the bottom and working successively upward and by sealing each hole before, during, and after the measurements, the in-place characteristics of the interstitial water remains essentially unchanged. —Authors' abstract

05467 **Friend, Peter.** Old Red Land of the Atlantic: Geog. Mag., v. 41, no. 9, p. 689-694, illus., 1969.

The Old Red Sandstone in East Greenland substantiates theories on the separation of the old continental landmass that split up 200 m.y. ago when the Atlantic Ocean appeared; Surtsey volcano, off Iceland, suggests continued widening. Devonian rocks, in the wide but sporadic distribution over the northern hemisphere, are of two types — marine and continental. Sediments collected from the deep Atlantic are not over 150 m.y. old. Both fringes of the Atlantic consistently lack sea-floor deposits but semisaucer intermontane basins 400 to 350 m.y. old are deeply alluviated (in Greenland, 12 km in thickness). The remarkable lithological similarity of the basins, the active volcanoes, concentration of earthquake epicenters, and a mid-Atlantic rift valley indicate continental drift. Magnetic surveys demonstrate outward spreading, at about 1 cm per year in each direction, and renewal of ocean floor by molten rock. — GDC

05292 **Frink, C. R.** Chemical and mineralogical characteristics of eutrophic lake sediments: Soil Sci. Soc. America Proc., v. 33, no. 3, p. 369-372, illus., tables, 1969.

Detailed chemical and mineralogical analyses of sediments of an eutrophic lake revealed that most characteristics usually associated with high productivity increased considerably with increasing depth of water. Thus, the center of the lake is enriched in clay, organic matter, N, and P when compared with sediments around the edge or soils in the watershed. Most changes in physical characteristics are attributed to size sorting during transport and deposition within the lake. Chemical changes also occur as sediment is transported from the acid watershed to the neutral lake environment; chief among these are dechloritization of Al-interlayered vermiculite and its subsequent conversion to illite, as well as a shift of stored phosphates from Al-P and Fe-P to Ca-P. Thus, these observations help to describe the process of eutrophication and serve as a basis for further analysis of the nutrient-supplying ability of lake sediments. —*from* Author's abstract

05227 **Frith, R. A.** Transition element distribution among orthopyroxene, clinopyroxene and hornblende in basic granulites [abs.]: Canadian Mineralogist, v. 10, pt. 1, p. 133, 1969.

Fritz, P. *See* Chrismas, L. 05158

05633 **Fullagar, Paul D.; Bottino, Michael L.** Rubidium-strontium age study of Middle Devonian Tioga Bentonite: Southeastern Geology, v. 10, no. 4, p. 247-256, illus., table, 1969.

Twenty-two whole-rock samples of Middle Devonian Tioga Bentonite were analyzed for Rb, Sr and Sr isotopic composition. All analyzed samples exhibit significant alteration of the original minerals. Fifteen of the 22 samples analyzed lie on a 310 m.y. isochron. The average "age" of all samples is 302 m.y. This average "age" is approximately 70-80 m.y., or only about 20 percent younger than expected for rocks of Middle Devonian age. Consequently, these results provide support for our previous suggestion that useful Rb-Sr age data might be obtained on weathered rocks of unknown age from areas where it is impossible to obtain fresh samples. — Authors' abstract

05054 **Fuller, M.** Magnetic orientation of borehole cores: Geophysics, v. 34, no. 5, p. 772-774, illus., 1969.

This paper discusses a method of borehole core orientation based on the observation that when a rock sample is progressively demagnetized in an a-c field, the magnetization vector moves away from the present field direction toward the ancient field direction because the viscous component parallel to the present field is demagnetized by very low a-c fields. In contrast, the component parallel to the ancient field direction is likely to be either TRM or CRM, both of which are extremely stable over long periods of time and against a-c demagnetization. An example of the procedure is given and some problems discussed. —GV

Furlow, James W. *See* Smith, James W. 05414

Furuta, T. *See* Berry, P. F. 05273

05469 **Fyfe, W. S.; Lanphere, M. A.; Dalrymple, G. B.** Experimental introduction of excess Ar^{40} into a granitic melt: Contr. Mineralogy and Petrology, v. 23, no. 3, p. 189-193, table, 1969.

Samples of a Precambrian granite were melted and sealed in capsules to produce a radiogenic Ar-40 atmosphere over the melt. The amount of Ar-40 incorporated in the quenched charge was then determined. Under these experimental conditions the amount of argon dissolved in the quenched melt was appreciable and could be an important source in potassium-argon dating. — Authors' abstract

05118 **Gallagher, John Neil.** A method for determining the source mechanism in small earthquakes with application to the Pacific Northwest region [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1210B, 1969.

05375 **Galle, O. Karmie.** Chemical analysis of some standard carbonate rocks: Chem. Geology, v. 5, no. 2, p. 143-146, tables, 1969.

Twenty limestone, dolomite and limestone-dolomite blends were analyzed. The samples, which are available from the G. Frederick Smith Chemical Company of Columbus, Ohio, were issued with an analysis certificate listing values for SiO_2, Fe_2O_3, CaO, and MgO. Additional analyses are reported and results compared with certificate values. — Author's abstract

05376 **Ganguly, Jibamitra.** Chloritoid stability and related paragenesis — Theory, experiments, and applications: Am. Jour. Sci., v. 267, no. 8, p. 910-944, illus., tables, 1969.

Chloritoid stability limits relative to coexisting minerals of regionally metamorphosed pelitic rocks have been investigated chiefly as a function of the total or solid pressure, temperature, and oxygen fugacity. Excess silica has a very small effect on the breakdown temperature of the mineral. Variation of oxygen fugacity within the field of magnetite changes the stability limit of the mineral. The breakdown equilibria are relatively insensitive to changes in total pressure. Chloritoid cannot be stable above 575-600°C, the transformation to staurolite taking place between 500 to 575°C. The assemblage chloritoid, diaspore, and kaolinite can be stable at oxygen fugacities within the field of hematite, less than 375° to 400°C. Petrographic evidence suggests the Al-silicate triple point should be between the equilibria Chd + $Al_2SiO_5 \rightleftharpoons St + Q + H_2O$ and Chd $\rightleftharpoons$ Alm + Cor + H_2O. —*from* Author's abstract

05144 **Gardner, Leonard Robert.** The Quaternary geology of the Moapa Valley, Clark County, Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1199B, 1969.

05302 **Garrett, Robert G.** The determination of sampling and analytical errors in exploration geochemistry: Econ. Geology, v. 64, no. 5, p. 568-569, 1969.

Analytical precision may be less important than sampling error as a factor governing whether or not errors are significantly smaller than overall data variability. Identical treatment of original and replicate samples, and collection of replicate samples at some 10 percent, but at least 30, of the sample sites of a survey should provide enough information to determine whether or not variability represents relevant information or has a significant chance of being due to a combination of sampling and analytical errors. —WSW

05362 **Gartner, Stefan, Jr.** Correlation of Neogene planktonic foraminifer and calcareous nannofossil zones [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2036, 1969.

05461 **Gartner, Stefan, Jr.** *Hayella* Roth and *Hayella* Gartner: Micropaleontology, v. 15, no. 4, p. 490, 1969.

Hayella Roth (P. H. Roth, 1968 [1969]) is shown to be both a junior synonym of *Ilselithina* Stradner [1966], and a junior homonym of *Hayella* Gartner [1969]. [All names refer to calcareous nannofossils.] — Author's abstract

05269 **Gazzara, C. P.; Stiglich, J. J., Jr.; Meyer, F. P.; Hansen, A. M.** A general computer program for particle size, *in* Advances in X-ray analysis, V. 12 — Applications of X-ray Analysis, 17th Ann. Conf., Denver, Colo., 1968, Proc.: New York, Plenum Press, p. 257-267, illus., tables; discussion, p. 267-268, 1969.

A computer program has been written in basic Fortran and tested for computing average particle size, strain, and particle size distribution according to the Fourier method of Warren. Optional features provided are input data, Fourier coefficient printout, automatic background correction, choice of fixed count or fixed time input mode, synthesized diffraction peaks deconvoluted with respect to the instrumental diffraction peak, and a variable amplifaction range of particle size. A polynomial fitting procedure for the scattering factor is included. This Fourier analysis program has been tested using known distribution functions, and has been used for measuring average particle size, particle size and strain distribution in heat-treated, boron-doped graphite samples. — Authors' abstract

05225 **Gendzwill, D. J.** Densities of Precambrian rocks of the Amisk Lake-Flin Flon area —A detailed study: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1227-1243, illus., tables, 1969.

Densities were determined for 1855 fresh bedrock samples taken from an area of about 110 sq mi in east-central Saskatchewan. [The average results are given in a table.] Density depends primarily upon mineral composition of the rocks which varies widely for many reasons. Metamorphism has changed density in some rocks by altering minerals such as bytownite to zoisite. Conversely, olivine and some pyroxene are changed to low density serpentine. Density measurements are used to subdivide the Amisk Group of metavolcanics, and certain areas are recommended for mineral prospecting. Evidence suggests that basic intrusions have increased the density of wallrocks by metamorphism. The Bouguer gravity field in the area is closely correlated with the densities of the outcropping rocks. The shape and depth of some rocks are estimated from the gravity. —*from* Author's abstract

05279 **Gendzwill, D. J.; Maybank, J.** Gravity variations and precipitation onset: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1322-1324, illus., tables, 1969.

Times of occurrence of maximum tidal gravity and maximum rate of change of this parameter are compared with times of rainshower onset at Saskatoon. It is concluded that no correlation exists at this location between the former and the latter data. A previous report that rain onset did tend to coincide with maximum rate of change of gravity at Pisa is compared with these present calculations and shown to be erroneous. — Authors' abstract

05413 **Georgia Department of Mines.** (Mining and Geology). Mineral resource map: [Atlanta, Ga.] Georgia Dept. Mines, Mining and Geology, scale 1:500,000, 1969.

Gibbs, J. F. *See* Healy, J. H. 05165

Gibson, Everett K., Jr. *See* Moore, Carlton B. 05101

05051 **Gigl, Paul D.; Dachille, Frank.** Effect of pressure and temperature on the reversal transitions of stishovite: Meteoritics, v. 4, no. 2, p. 123-136, illus., tables, 1969.

Facts are presented to support the hypothesis that naturally occurring stishovite can be formed only by impacts of great magnitude, and hence is a very good index mineral for identifying astroblems. It is noted that for stishovite to remain as a stable phase it would have to be located at least 350 km below the surface. Exposure to pressure-temperature regions of up to 20 kb and 400°C for only a few days will cause complete conversion of stishovite to quartz, and since no known geological process could bring material from such depths without subjecting it to long dwelling times in this p-t region, it is concluded that the stishovite found on the surface must have been formed in place. —GV

Gile, L. H. *See* Flach, K. W. 05647

05154 **Gill, J. E.** Experimental deformation and annealing of sulfides and interpretation of ore textures: Econ. Geology, v. 64, no. 5, p. 500-508, illus., table, 1969.

Annealing and intrusion (high strain rates) experiments at pressures up to 1724 bars and temperatures up to 996°C "show that plastic flow occurs very quickly in galena, chalcocite, bornite, pyrrhotite, and chalcopyrite at temperatures within the ranges recognized for the greenschist and amphibolite rock facies." Sphalerite may adjust by minor twinning or fracture, and pyrite by fracture, if at all. Higher pressures and lower strain rates probably lower the temperatures at which flow occurs. — WSW

Gillum, S. E. *See* Morgan, J. W. 05487

05363 **Gilreath, J. A.; Healy, J. S.; Yelverton, J. N.** Depositional environments defined by dipmeter interpretation [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2036, 1969.

Ginsburg, R. N. *See* Shinn, Eugene A. 05099

Gittins, J. *See* York, Derek. 05476

05196 **Go, James C.** On Stoneley waves along curved interface [abs.]: Earthquake Notes, v. 40, no. 2, p. 4, 1969.

Goebel, Edwin D. *See* Thompson, Thomas L. 05466

Goldstein, Robert F. *See* Andress, Noel E. 05341

05364 **Goldstein, Robert F.; Cramer, Fritz H.; Andress, Noel E.** Silurian chitinozoans from Florida well samples [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2036-2037, 1969.

Goodell, H. G. *See* Hopkins, E. 05368

05176 **Gordon, David W.** The southern Illinois earthquake of November 9, 1968 — Macroseismic effects [abs.]: Earthquake Notes, v. 40, no. 2, p. 14-15, 1969.

Gordon, George E. *See* Gotautas, Vito A. 05365

05145 **Gordon, Terence Michael.** Some silicate-carbonate phase relations in H_2O-CO_2 mixtures [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1199B-1200B, 1969.

05365 **Gotautas, Vito A.; Gordon, George E.; Johnson, Johnnie; Lee, Clyde.** Southwest Lake Arthur field, Cameron Parish, Louisiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2037, 1969.

05216 **Gough, D. I; Heirtzler, J. R.** Magnetic anomalies and tectonics of the Cayman Trough: Royal Astron. Soc. Geophys. Jour., v. 18, no. 1, p. 33-49, illus., 1969.

A magnetic residual total-field anomaly map has been prepared for the Cayman Trough, Cayman Ridge, and part of the Nicaragua Rise. The map shows linear anomalies along the north and south bounding walls of the Cayman Trough east of long. 82° W.; that on the north has two maxima and terminates just west of Grand Cayman. Further west a more irregular positive anomaly follows the north wall of the Trough. On the basis of tectonic and geophysical evidence it is concluded that very large strike-slip movements have occurred in both walls of the Cayman Trough and that the Trough has been formed by these and by simultaneous opening tension. The linear magnetic anomalies arise from juxtapositions of magnetic and nonmagnetic rocks in the walls arising in the large strike-slip displacements. —*from* Authors' abstract

05640 **Grachev, A. F.; Ivanov, S. S.; Karasik, A. M.; Ushakov, S. A.** The Arctic rift system: [Ottawa] Canada Defense Board Defence Sci. Inf. Service [T 515 R], 7 p., 1969; originally published in Russian, *in* Naucho-Issled. Inst. Geologii Arktiki Uchennye Zapiski, no. 10, p. 65-70, 1967.

Evidence is presented for a continuation of the Mid-Labrador Sea Ridge rift zone northward through Kennedy Strait into the Amundsen Basin where it joins the Hakkel' Ridge rift zone as follows: (1) epicenters of earthquakes of about M = 5 are distributed along the line of the strait; (2) Hakkel' Ridge occupies a median position only in part of the Amundsen-Nansen basin; and a northward prolongation of the axis of Kennedy Strait traces a median line in Lincoln Sea; (3) if a rift zone exists in Lincoln Sea, it may be presumed to lie about along the median where soundings indicate a chain of hills along the prolongation into Amundsen basin. — VSN

05662 **Graham, E. R.; Lopez, P. L.** Freezing and thawing as a factor in the release and fixation of soil potassium as demonstrated by isotopic exchange and calcium exchange equilibria: Soil Sci., v. 108, no. 2, p. 143-147, tables, 1969.

All soils when depleted of K would release K from lattice positions to the labile pool when subjected to freezing and thawing. Ca-saturated soils released more than twice as much K as NH_4-saturated soils. When 2 to 4 times the original amount of K was added, fixation occurred suggesting movement of K from the labile pool to the lattice position. — JWH

Graham, E. R. *See* Brees, D. R. 05664

Grantz, Arthur. *See* Clark, Malcolm M. 05167

Graves, James R. *See* Morrow, Norman R. 05661

05566 **Green, Harry Western, 2d.** Syntectonic and annealing recrystallization of fine-grained quartz aggregates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 709B, 1969.

Green, Martha A. *See* Smith, James W. 05414

05044 **Greenwood, Eugene.** Oil and gas in the Pedregosa basin: Oil and Gas Jour., v. 67, no. 40, p. 171-173, illus., 1969.

During Paleozoic time the Pedregosa basin, in southeastern Arizona, southwestern New Mexico, and northeastern Mexico, was similar to the well-known Midland and Delaware basins of western Texas and New Mexico that yield large amounts of oil and gas. The Pedregosa basin has potential source rocks, reservoir rocks, and trapping mechanisms that are identical to those in west Texas fields. Porous carbonate rocks of Ordovician, Silurian, Mississippian, Pennsylvanian, and Permian age and porous carbonates and sands of Early Cretaceous age may contain appreciable amounts of oil and gas. Subsurface data are scarce and more drilling is needed, since many important geologic relationships are obscured by deformation and deposition that occurred during Late Cretaceous and Tertiary time. —WBC

Griffin, G. M. *See* Manker, J. P. 05315

05366 **Griffin, G. M.; Tedrick, P. A.; Reel, D. A.; Manker, J. P.** Geothermal gradients in Florida and southern Georgia [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2037, 1969.

05584 **Griffin, Villard S., Jr.** Migmatitic Inner Piedmont belt of northwestern South Carolina, *in* A guide to the geology of northwestern South Carolina — Carolina Geol. Soc. Guidebook, 1969: South Carolina Div. Geology Geol. Notes, v. 13, no. 4, p. 87-104, illus., 1969.

A major tectonic slide separates the Inner Piedmont into a northwestern part and a migmatitic part; the slide is the sole of the Walhalla nappe. The Six Mile nappe overlies the Walhalla nappe and is separated from it by another tectonic slide. The rocks in the Walhalla nappe are in the lower almandine amphibolite facies and are from an unstable shelf assemblage formed during late Precambrian or Early Cambrian time; the rocks in the Six Mile nappe are from a eugeosynclinal suite formed to the southeast and are probably late Precambrian or early Paleozoic in age. The Six Mile nappe flowed over the Walhalla nappe during middle to late Paleozoic orogenesis; the Walhalla nappe compressed and overrode in like manner the rocks to the northwest which were compressed against the Blue Ridge. — *from* Author's abstract

05094 **Griggs, G. B.; Kulm, L. D.** Glacial marine sediments from the northeast Pacific: Jour. Sed. Petrology, v. 39, no. 3, p. 1142-1148, illus., tables, 1969.

Sediments were cored in the Cascadia basin as far south as 44°10′ N. Uniform distribution of sand grains and pebbles in clay indicate ice-rafting as the depositional mechanism. Clay mineralogy and pebble petrology suggest that the provenance was the Puget Lowland and adjacent mountains in Washington and British Columbia. The distribution of the glacial marine deposits indicates that Pleistocene circulation must have been very similar to that of today. Icebergs could have been carried south

by the portion of the West Wind Drift that intrudes into the area of Vancouver Island and then moves southward along the coast. As the ice melted, it left a trail of debris 400 km south of the previously believed boundary for these deposits. —*from* Authors' abstract

Grimes, W. H. *See* Frey, M. G. 05360

Gross, D. L. *See* Totten, S. M. 05500

Gude, A. J. *See* Hemley, J. J. 05294

05226 **Gulbrandsen, R. A.** Physical and chemical factors in the formation of marine apatite: Econ. Geology, v. 64, no. 4, p. 365-382, illus., tables, 1969.

The ubiquitous phosphorite-organic matter association suggests that organisms are an essential part of the marine phosphorus cycle because of their ability to secrete phosphorus, transport it between environments, and ultimately release it to sediments. "Optimum conditions for the formation of large amounts of apatite seem to be the coincidence of a special steady supply of phosphate, originally derived from organic matter, and a decreased capacity of sea water for phosphate. These conditions probably prevail in shallow parts of the seas upon continents where large amounts of organic matter accumulate in oxygenated waters of higher than normal temperature, pH, and salinity." —WSW

Gunn, B. M. *See* Watkins, N. D. 05092

05043 **Hajek, Benjamin F.; Wildung, Raymond E.** Chemical characterization of pond sediments: Northwest Sci., v. 43, no. 3, p. 130-134, tables, 1969.

The following physical and chemical properties of pond sediments and associated interstitial waters were determined using common soil analysis methods, in the Rattlesnake Springs ecology reserve near Richland, Wash.: exchangeable cations; soluble cations (solution cations in equilibrium with exchangeable cations); cation exchange capacity; particle size distribution; content of organic carbon; content of humate, elementary composition (C, H, N), and humate cation exchange capacity. Soil analysis techniques were found to give reproducible results without apparent interference when applied to sediment systems, thus simplifying future investigations of particulate behavior in the aquatic environment. —VMJ

05472 **Hales, A. L.** A seismic discontinuity in the lithosphere: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 44-46, 1969.

Seismic observations of the traveltimes from explosions in Lake Superior on profiles both north and south of the lake show an increase in apparent velocity at a distance of about 650 km. These observations imply that there is a seismic discontinuity at which the velocity increases from about 8.05 to 8.3 to 8.45 km/sec at a depth of 80-90 km. It is suggested that this change may arise from the transition from spinel to garnet peridotite. — Author's abstract

Haller, W. A. *See* Cooper, J. A. 05285

Hallett, R. *See* Pierce, T. B. 05286

05643 **Hallsworth, E. G.; Beckmann, G. G.** Gilgai in the Quaternary: Soil Sci., v. 107, no. 6, p. 409-420, illus., table, 1969.

Gilgai is used as the generic name for a type of soil microrelief having certain features described by the author. Several forms of gilgai microrelief show characteristic swelling profiles indicating a predominance of montmorillonite. Some gilgai soils have montmorillonite and others contain kaolinite and illite. — JWH

Hamilton, M. *See* Nishita, H. 05668

05162 **Hamilton, Robert M.** Aftershocks of the Borrego Mountain, California, earthquake of 9 April 1968 [abs.]: Earthquake Notes, v. 40, no. 2, p. 26, 1969.

05185 **Hamilton, Robert M.; Healy, John H.** Seismic activity associated with nuclear explosions [abs.]: Earthquake Notes, v. 40, no. 2, p. 21, 1969.

Hansen, A. M. *See* Gazzara, C. P. 05269

05048 **Hansen, Spenst M.** A crater formed by gas erosion of a nuclear explosion vent: Meteoritics, v. 4, no. 2, p. 61-88, illus., 1969.

The Palanquin experiment was a 4.3 kt nuclear explosion detonated at a depth of 280 feet in layered trachytic rocks at the Nevada Test Site. The resulting apparent crater had an unusual conical shape and dimensions of 119.1 feet radius and 78.8 feet depth. The mechanism of crater formation was the venting of high temperature, high pressure gas out of the open emplacement hole when the upper part of the steel casing was ejected. The ensuing erosion of the sides of the hole caused a progressive increase in the size of the vent opening. Fallback and slumping of adjacent weakened and fractured rock partially filled the true crater. Evidence from this experiment indicates that the configuration of a gas erosion nuclear crater is dependent in part on size and orientation of the gas escape channel. A similar mechanism might produce natural craters by venting of high pressure gas from deep volcanic activity along zones of weakness. —GV

05146 **Hanson, Henry William Andrew, 3d.** Petrogenesis of graywacke in a mid-Paleozoic, northern Appalachian epieugeosyncline [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1200B, 1969.

Harbison, R. N. *See* Weeks, L. A. 05335

05432 **Hardin, Bobby O.; Black, William L.** Vibration modulus of normally consolidated clay — Closure [to discussion of paper 5833, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM6, p. 1531-1537, illus., tables, 1969.

Since publication of this paper (ibid., v. 94, no. SM2, 1968), the writers have tested many undisturbed samples of various soils, results of which are presented herein to further ascertain the validity of their proposed equation for shear tests in laboratory and in situ. Index properties and classification of the soils tested, mostly shelby tube samples and two block samples, are shown in one table for twelve taken from various depths between 7.5 and 94 feet. Test results show effects of void ratio, ambient stress, stress history, frequency, and strain amplitude on the vibration shear modulus. The special structure of highly sensitive clays appears to increase the modulus above that for less sensitive soils with similar void ratio and state of stress. — GDC

05182 **Harding, Samuel T.; Dillinger, William H.; Pope, Allan.** Focal mechanism determinations using P- and S-wave data [abs.]: Earthquake Notes, v. 40, no. 2, p. 19, 1969.

05274 **Harington, C. R.** Pleistocene remains of the lion-like cat (*Panthera atrox*) from the Yukon Territory and northern Alaska: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1277-1288, illus., tables, 1969.

Skull and forelimb fragments of the large, extinct cat (*Panthera atrox*) from Pleistocene sediments in the Dawson area, Yukon Territory, are the first records of the species for Canada. A further specimen from the Kaolak River, near the arctic coast of Alaska, significantly extends the known northward range of this cat. The species has been reported from approximately 26 localities from Alaska to Peru, and may have migrated from Eurasia just prior to the Sangamon interglacial. Data reviewed suggest that *Panthera atrox* from North America, the Eurasian 'cave lion' *Panthera leo spelaea*, and the large Chinese cat *Panthera youngi* are conspecific. — Author's abstract

Harms, T. F. *See* Ward, F. N. 05310

05087 **Hart, S. R.** K, Rb, Cs contents and K/Rb, K/Cs ratios of fresh and altered submarine basalts: Earth and Planetary Sci. Letters, v. 6, no. 4, p. 295-303, illus., tables, 1969.

High K/Rb and K/Cs ratios appear to be a primary feature of submarine tholeiite magmas, though the trend of decreasing K/Rb with increasing K content is shown to be a probable result of later alteration, both during low grade metamorphism and during exchange with sea water. Sea water exchange results in enrichments of K, Rb, and Cs of 2, 5 and 20 times, respectively, in outer altered margins of submarine basalt fragments. Eight relatively unaltered samples give an average K/Rb of 940, and this ratio shows little significant trend over K contents ranging from 430-4500 ppm. The average Cs content of these unaltered samples is 0.024 ppm and the average K/Cs ratio is 70,000. Averages for K and Rb contents are 1550 ppm and 1.8 ppm, respectively. — Author's abstract

05522 **Hasegawa, H. S.** A study of the effects of the Yellowknife crustal structure upon P coda of teleseismic events: Royal Astron. Soc. Geophys. Jour., v. 18, no. 2, p. 159-175, illus., tables, 1969.

The short-period P codas of seven earthquakes and four underground nuclear events recorded in the Yellowknife region of the Canadian Shield are analyzed both in the time and in the frequency domains. In the time domain, the application of a "P-detection" filter to the earthquake events facilitates the identification of several phases (pP and sP) in the first 25 s of the P coda. The application of this filter to two nuclear events (originating at the Nevada Test Site) assists in the separation and in the identification of the crustal reverberations at the respective sources. In the frequency domain studies, the application of the spectral ratio test to six earthquake events results in poor agreement between the theoretical and the experimental spectral ratio curves; closer agreement was obtained for the nuclear events. — *from* Author's abstract

05585 **Hatcher, Robert D., Jr.** Stratigraphy, petrology, and structure of the low rank belt and part of the Blue Ridge of northwesternmost South Carolina, *in* A guide to the geology of northwestern South Carolina — Carolina Geol. Soc. Guidebook, 1969: South Carolina Div. Geology Geol. Notes, v. 13, no. 4, p. 105-141, illus., table, 1969.

This belt lies to the northwest of the high rank Inner Piedmont. The Chauga River Formation contains an upper and lower Brevard phyllite member, a middle carbonate member, and a basal graphitic phyllite member. The Poor Mountain Formation has a marble-quartzite member, an amphibolite member, and the Brevard-Poor Mountain transitional member. The Poor Mountain is a southeastern facies of the Chauga River; both are traceable into Georgia. These underlie the Henderson Gneiss, which is a thick feldspathic quartzite-arkose unit containing augen. The Whetstone Group, metagraywacke, metasandstone, and schist, occurs in the Blue Ridge northwest of the Brevard Zone and is late Precambrian. The other units are of late Precambrian or early Cambrian. Isoclinal folding and tectonic sliding were followed by Brevard faulting, shearing and cataclasis. — *from* Author's abstract

05147 **Hatheway, Richard Brackett.** Geology of the Wiscasset quadrangle, Maine [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1200B-1201B, 1969.

Hay, William W. *See* Marszalek, Donald S. 05317

Hay, William W. *See* Čepek, Pavel. 05353

05367 **Haye, Edward F.** Photogeologic applications in Gulf Coast [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2037, 1969.

05072 **Hayes, William C.; Vineyard, Jerry D.** Environmental geology in towne and country: Missouri Geol. Survey and Water Resources Educ. Ser. 2, 42 p., illus., 1969.

This popular account asks three questions and summarizes the answers: what is environmental geology?—the past, and today; why is environmental geology important?—to avoid mistakes and to meet growing needs; (3) how is environmental geology used?—in physical planning and in wise land use. Factors of the subject are: topography, soils, surface and ground water, minerals, and modifications by man. By combining talents and knowledge of geologists and other scientists, every facet of man's environment can be considered. Suggestions are listed for further reading. —MCM

Heald, M. T. *See* Renton, J. J. 05106

05165 **Healy, J. H.; Gibbs, J. F.; Warren, D. H.** A seismic calibration of the Large Aperture Seismic Array, Montana [abs.]: Earthquake Notes, v. 40, no. 2, p. 7, 1969.

Healy, J. S. *See* Gilreath, J. A. 05363

Healy, John H. *See* Hamilton, Robert M. 05185

Hearn, B. Carter, Jr. *See* Milton, Charles. 05412

Heirtzler, J. R. *See* Gough, D. I. 05216

05424 **Heirtzler, J. R.** The theory of sea floor spreading: Naturwissenschaften, v. 56, no. 7, p. 341-347, illus., 1969.

The theory of sea-floor spreading appears to explain many types of geophysical and geological observations such as the distribution of earthquakes; origin of oceanic ridges, trenches, and faults; and geomagnetic, gravity, and heat flow anomalies in many marine areas. It confirms the theory of continental drift and provides many details about the motion of the continents during geologic time, and suggests many new relationships concerning the Earth. This paper reviews some of the research that has led geophysicists to accept sea-floor spreading. — DBV

05567 **Helmstaedt, Herwart.** A structural analysis of Beaver Harbour area, Charlotte County, New Brunswick [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 710B, 1969.

05294 **Hemley, J. J.; Hostetler, P. B.; Gude, A. J.; Mountjoy, W. T.** Some stability relations of alunite: Econ. Geology, v. 64, no. 6, p. 599-612, illus., tables, 1969.

Alunite stability relations were studied experimentally at 200-380°C and 15,000 psi total pressure, and invariant points determined for the system alunite-muscovite-kaolinite-K-feldspar-quartz in terms of total molal H_2SO_4 and K_2SO_4. "The effect of pressure is small. . . Alunite-kaolinite (including dickite or pyrophyllite) are shown to be the most likely products of. . .alteration processes [at high H_2SO_4 concentration] in either hot spring or higher temperature environments, whereas muscovite-alunite is favored by higher temperature as well as higher potassium concentrations." —WSW

05155 **Henderson, F. B., 3d.** Hydrothermal alteration and ore deposition in serpentinite-type mercury deposits: Econ. Geology, v. 64, no. 5, p. 489-499, illus., tables, 1969.

The Mt. Jackson mine, California, is considered typical of mercury-sulfide deposits in serpentinite and genetically similar to those in other host rocks. It is used as the example in an attempt to deduce the character of the ore-forming solution by study of its products — altered rock, ore,gangue, and the spent solution represented by waters from springs geologically related to mercury deposits. "The dominant chemical control of the mercury sulfide deposition. . .is the contemporaneous reaction between the thermal springs ore solution and the serpentinite host rock." The original ore solution may represent sedimentary connate waters equilibrated with their host sediments. —WSW

05526 **Henderson, G.** The use of structural contour maps in the study of gneiss-metasediment relations in the Umanak area, West Greenland, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 129-142, illus., table, 1969.

In the Umanak area, a gneiss complex of three formations, the Umanak Gneiss, is overlain by the metasedimentary Karrat Group of two formations, the lower, up to 3 km thick, consisting of quartzite, pelitic and semipelitic schist, and hornblende schist, the upper a metagraywacke over 5 km thick, all of Precambrian age. Although there are transitional features in the boundary zone, suggesting possible derivation of the gneiss by migmatization of the lowermost metasediments, the regional structural pattern of domes, overfolds, and nappes is better explained as having evolved through upwelling of a buoyant Umanak Gneiss basement through the younger metasediments, with downward sliding on the flanks of the upwellings (domes) producing overfolds and nappes. The Karrat Group rocks show a distinctly higher grade of metamorphism close to the gneiss. — VMJ

05148 **Henderson, Gerald Vernon.** The origin of pyrophyllite-rectorite in shales of north central Utah [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1201B, 1969.

05270 **Henke, Burton L.; Lent, Robert E.** Some recent work in low energy X-ray and electron analysis, *in* Advances in X-ray analysis, V. 12 — Applications of X-ray Analysis, 17th Ann. Conf., Denver, Colo., 1968, Proc.: New York, Plenum Press, p. 480-495, illus., tables, 1969.

Research is being conducted on low energy X-ray and electron physics and application in the 100-1000 eV region. Work on the optimization of fluorescence analysis for light elements, including the development of efficient dispersive systems as the multilayer analyzers of the Langmuir-Blodgett type, has been continued. Along with the ultrasoft X-ray program has been one on photoelectron and Auger electron spectroscopy. An evaluation of the application of low energy electron spectroscopy for surface characterization is being made. — Authors' abstract

05527 **Henriksen, Niels.** Boundary relations between Precambrian fold belts in the Ivigtut area, southwest Greenland, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 143-154, geol. map, 1969.

The northern boundary zone of the Ketilidian fold belt passes through the Ivigtut area. Pre-Ketilidian rocks to the north consist of infrastructural gneisses enclosing a belt of locally migmatized supracrustal rocks, both unconformably overlain by weakly deformed Ketilidian supracrustals. Southward, Ketilidian deformation and plutonism gradually change the original unconformity into an allochthonous contact between infra- and supracrustal rocks, with formation of granites; metamorphic grade increases from low greenschist to amphibolite facies. Trends of cratogenic basic dikes help in distinguishing Ketilidian structure in the reactivated basement from the inherited structure. All K-Ar dates in the area are about 1600 m.y., reflecting late Ketilidian plutonism; K-Ar dates on pre-Ketilidian rocks farther north are 2500 to 2700 m.y. — VMJ

05626 **Henriksen, Niels; Higgins, A. K.** Preliminary results of mapping in the crystalline complex around Nordvestfjord, Scoresby Sund, East Greenland: Grönlands Geol. Undersögelse Rap. 21, p. 5-20, geol. map, 1969.

The following are recognized and described briefly: the crystalline complex; Charcot Land supracrustal sequence; Charcot Land infracrustal complex; a tillite and age of the Charcot Land sequence (Eocambrian,); Hinks Land overthrust; Flyverfjord infracrustal complex; Krummedal supracrustal sequence; migmatites and autochthonous-parautochthonous granites; exceedingly complex structures; allochthonous granites; and postkinematic basic dikes. Some generalized conclusions are included regarding correlations with rocks in other parts of Greenland. — HRC

05610 **Herfindahl, Orris C.** Natural resource information for economic development: Baltimore, Md., Johns Hopkins Press (for Resources for the Future), 212 p., illus., tables, 1969.

Although this study deals primarily with situations in Latin America, especially Chile and Peru, it is also of interest and has value for other parts of the world to both developing countries and countries interested in encouraging economic development. Natural resource information and development are only a small part of production and growth; complexities arise because of the involvement of many specialties. The importance of geological investigations — soil, geophysical, and geochemical surveys; maps of various kinds; and hydrologic data — are stressed in several of the eight sections. Factual information on natural resources should be considered as a type of investment by governmental agencies. — MCM

Herglotz, H. K. *See* Davies, R. D. 05271

Herlihy, Daniel E. *See* Fagg, Clint F. 05358

05485 **Hermance, J. F.** Resolution of ocean floor magnetotelluric data: Jour. Geophys. Research, v. 74, no. 23, p. 5527-5532, illus., 1969.

Ocean floor electrical deep-sounding experiments offer a means of determining the temperature distribution beneath anomalous ridges or the ocean basins, since the electrical resistivity of earth materials depends on temperature. Synthetic data are generated to illustrate two problems inherent in these experiments: short-lived fluctuations are severely damped by the conducting sea water and, as a result, resolution of experimental data using present techniques is very poor. The resulting uncertainty in thickness estimates based on this type of analysis precludes the possibility of seeing structure in the thermal gradient to depths of tens of kilometers, although the resistivity of the deep layer, and hence the temperature of the deep layer can be determined quite accurately. — GV

Heron, S. Duncan, Jr. *See* Swift, Donald J. P. 05642

Hess, Frederick R. *See* Anderson, Franz E. 05029

Hey, M. H. *See* McConnell, Duncan. 05494

Hey, M. H. *See* Smith, J. V. 05495

05656 **Heyman, Louis.** Geology of the Elk Run gas pool, Jefferson County, Pennsylvania: Pennsylvania Geol. Survey, 4th ser., Bull. M 59 (Mineral Resources Rept.), 18 p., illus., 1969.

The Elk Run gas pool is a stratigraphic trap typical of the NE-SW trending series of 'Oriskany' gas pools on the east limb of the Sabinsville anticline; entrapment is due largely to an updip porosity loss, about a mile downdip from a regional pinchout of the Ridgeley Sandstone. Minor portions of the entrapment are due to a NE-SW trending fault at the north end of the pool, and a SW-plunging nose at the south end. Downdip entrapment is against the gas-water contact at -5,940 feet. Porosity is largely intergranular, with a maximum of about 20 percent and a mean of 7.75 percent, increasing in quality and thickness downdip. The reservoir is considered to be localized by distribution of Ridgeley Sandstone having greater than 6 percent porosity. Original producible gas in place is estimated at 46,670,000 MCF, with a recovery factor of 809.7 MCF per acre-ft. — *from* Author's abstract

05370 **Hickin, Edward J.** A newly-identified process of point bar formation in natural streams: Am. Jour. Sci., v. 267, no. 8, p. 999-1010, illus., 1969.

Sedimentation on stream bends developed at supercritical flow in a flume is examined in terms of model which outlines the process by which deposits on the convex sides of meanders (point dunes) are formed. This mode of deposition also occurred at existing bends of the flume channel when flow was subcritical and nonmeandering.

Point dunes, which are examples of a feature in dynamic equilibrium, may also occur naturally when streams flowing over coarse noncohesive material are forced to change direction at valley bends. Field evidence, including a pilot mechanical analysis of sediment from a natural point dune, is presented which strongly supports the possibility. Significance and implications of the possible accordance of point dune and flood plain surfaces are discussed briefly. — *from0* Author's abstract

Higgins, A. K. *See* Henriksen, Niels. 05626

05596 **Hill, D. E.; Sawhney, B. L.** Electron microprobe analysis of thin sections of soil to observe loci of cation exchange: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 531-534, illus., 1969.

Electron microprobe analysis of thin sections of Cs-saturated soil demonstrated the relation between micromorphology and the loci of cation exchange in natural soil. X-ray scanning images and Cs activity measurements made possible quantitative comparison of the Cs sorption capacity of clay-enriched microstructures, silty matrices, and weathered biotite sand grains. — Soil brief

05229 **Hill, William T.; McCormick, J. Edward; Wedow, Helmuth, Jr.** Problems on the origin of ore deposits in the Lower Ordovician formations of East Tennessee [abs.]: Econ. Geology, v. 64, no. 3, p. 349-350, 1969.

05618 **Hills, L. V.; Wallace, Sandra.** *Paraalnipollenites*, a new form genus from uppermost Cretaceous and Paleocene rocks of Arctic Canada and Russia [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 139-145, illus., 1969.

Paraalnipollenites a new form genus is described and illustrated from the Eureka Sound Formation of Bathurst Island, District of Franklin. The type species *P. confusus* (Zaklinskaia, 1963) was first described as *Triatriopollenites confusus* Zaklinskaia. In arctic Canada it occurs in the Eureka Sound Formation, Bathurst Island, and in the Reindeer Formation, District of Mackenzie. In the Eureka Sound Formation associated spores, pollen grains, and dinoflagellates indicate that the sediments are of Maestrichtian age, whereas in the Reindeer Formation a Paleocene age is indicated. — Authors' abstract

05207 **Hilpert, Lowell S.** Uranium resources of northwestern New Mexico: U.S. Geol. Survey Prof. Paper 603, 161 p., illus., tables, geol. map, 1969.

In January 1966, mine reserves for northwestern New Mexico totaled 29.7 million tons of material that averaged 0.23 percent U_3O_8. Undiscovered or potential reserves may amount to as much as 200 million tons of material, which is expected to average about 0.25 percent U_3O_8. These resources are expected to be found almost entirely in peneconcordant deposits, principally in large ones in sandstone beds in the Morrison Formation; but important deposits are also anticipated in sandstone beds in the Dakota Sandstone and in deformed limestone beds in the Todilto Limestone. Most of the resources are expected to be concentrated in the southern San Juan Basin mineral belt. Structural and stratigraphic data indicate that the peneconcordant deposits were emplaced shortly after deposition of the host rocks and were concentrated along the margins of sedimentary basins. — LSH

05575 **Hintze, Lehi F.** Geologic road log between Provo, Utah and Ely, Nevada, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 8/1-8/29, illus., 1969.

This is a road log for a field trip beginning in Provo, continuing to Delta, Utah, and thence to Ely, Nev. The trip is 204 miles long and makes four stops, each of which is described; geologic observations along the way are also included. Stops are made at the Nebo overthrust, the Wheeler amphitheater trilobite locality in the House Range, the Conger Spring fossil location in the Confusion Mountains, and the decollement surface on the east side of the Snake Range. — HRC

05406 **Hironaka, Melvin C.; Smith, Raymond J.** Foundation study for materials test structure: Am. Soc. Civil Engineers Proc., v. 95, paper 6921, Jour. Soil Mechanics and Found. Div., no. SM6, p. 1431-1451, illus., tables, 1969.

A foundation study was conducted to determine suitability of the proposed site for placement of the Submersible Test Unit II, an area approximately two miles square in vicinity of 34°05.5′ N., 120°43′ W., some 14 miles west of San Miguel Island, Calif. Eight cores were taken to determine engineering properties of sediments. A bathymetric chart was constructed using data obtained from the Precision Depth Recorder and positioning instruments aboard the USS MOLALA. With resulting data from laboratory tests on samples, computations indicate: calculated average bearing capacity was 300 psf; based on applied structural loading pressure of 110 psf, total settlement was calculated to be 1.7 in. Statistical evaluation of test results formulated relationships for vane shear strength and bulk wet density that could be used in site reconnaissance studies. — *from* ASCE abstract

05593 **Hoekstra, Pieter.** Water movement and freezing pressures: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 512-518, illus., table, 1969.

Pressures develop when cylindrical columns of saturated soils are frozen unidirectionally under conditions of constant volume with an open water supply at the warm side. The value and behavior of these pressures depend on soil type.If water migration can take place in the frozen soil and ice lenses grow behind the freezing front the value of the pressure occurs in clayey soils, and the pressure is theoretically limited by the phase transition I - water. Values of 100 atm have been measured experimentally. In soils where water migration in the frozen soil does not occur and ice lenses form at the freezing front, the pressure reaches a constant value, which may vary between 0.2 atm for a sand soil and 3 atm for a silt soil. Thermodynamic models proposed to explain these phenomena are discussed. — Author's abstract

05637 **Hollenbeck, R. P.; Tyrrell, M. E.** Ceramic evaluations of clays and shales in east Tennessee: Tennessee Div. Geology Rept. Inv. 25, 22 p., illus., tables, 1969.

Sixty samples of clay and shale from East Tennessee were tested and the results were evaluated to determine the potential uses of these raw materials. Thirty-four of the samples were evaluated as potential raw material for face brick, and two samples were evaluated as potential raw material for face brick and structural tile. None of the samples were suitable for the manufacture of lightweight aggregate by the rotary-kiln method. — Authors' abstract

05012 **Holliday, D. W.** The origin of penemosaic texture in evaporites of the Detroit River Formation (Middle Devonian) in northern Indiana—Discussion of a paper by L. F. Rooney and R. R. French [1968]: Jour. Sed. Petrology, v. 39, no. 3, p. 1256-1258, illus., 1969.

Much work on nodular sulfate rocks has shown that they are formed by penecontemporaneous growth of gypsum and anhydrite often with a complex early diagenetic relationship within the host sediment, resulting in a wide variety of textures. The penemosaic structures noted by Rooney and French (ibid., v. 38, p. 755-765, 1968) were formed by such a process rather than by wave action and density settling. —HRC

05638 **Holman, J. Alan.** Herpetofauna of the Pleistocene Slaton local fauna of Texas: Southwestern Naturalist, v. 14, no. 2, p. 203-212, table, 1969.

The herpetofauna of the Slaton quarry of Lubbock County, Texas, consists of at least 18 forms, including 6 amphibians and 12 reptiles. None of these are thought to be extinct. Most of these animals lived near the edge of a shallow Pleistocene lake, but a few lived in a nearby area of sandy flats with some rocky outcrops. The herpetological members of the Slaton local fauna would not typically be found living together today as some Austroriparian forms are present among a mainly Kansan assemblage. The southern forms indicate that winters were milder than at present. — Author's abstract

05540 **Holmes, J. W.** On the absolute fall of sea-level during the Quaternary: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 6, no. 3, p. 237-239, 1969.

The discrepancy between the decline in sea level since the beginning of the Quaternary period, and the volume of sea water stored in the world's ice may be accounted for partly by a contemporaneous increase in water content of the land masses of Earth. The assumption required is that precipitation upon the continents has increased and has caused a general rise in water tables of some hundreds of meters. — Author's summary

05542 **Holmes, J. W.** On the absolute fall of sea-level during the Quaternary — A reply [to 1969 discussion by R. W. Fairbridge of 1969 paper]: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 6, no. 3, p. 242, 1969.

Fairbridge's argument [ibid., p. 241-242] is irrelevant to the original premise [ibid., p. 237-239], that the Tertiary closed two million years ago (or less) in an arid phase and that the water tables of the continents generally were then lower than they are now. — HRC

05368 **Hopkins, E.; Chesser, S.; May, J.; Poche, D.; Goodell, H. G.** Relict nature of sediments and submarine topography off Alligator Harbor, Florida [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2037-2038, 1969.

05090 **Horai, Ki-iti; Simmons, Gene.** Spherical harmonic analysis of terrestrial heat flow: Earth and Planetary Sci. Letters, v. 6, no. 5, p. 386-394, illus., tables, 1969.

Coefficients of the Earth's thermal field to the 7th degree, from almost 3,000 values, are reported; they are presented on a small-scale world map with a grid of 5° latitude and longitude. Averages are given for each grid in tables. The spherical harmonic coefficients to degree 7 were obtained by Fougere's method. The resemblance of the shape of the heat flow field and gravity field is not so pronounced at this level. Only a small portion of the Earth is currently covered by these heat flow measurements, but because of the knowledge of the relations between heat flow and regional geology, new data are not likely to change the pattern already recognized. —HRC

05103 **Horai, Ki-iti; Simmons, Gene.** Thermal conductivity of rock-forming minerals: Earth and Planetary Sci. Letters, v. 6, no. 5, p. 358-368, illus., tables, 1969.

New values of the thermal conductivity, K, of 119 rock-forming minerals reveal the following empirical relationships: (1) K is a linear function of density for constant mean atomic weight (similar to Birch's law for the velocity of compressional waves); (2) the K of the silicates is controlled by the structure of the silicon-oxygen network; (3) within a group of minerals of similar crystal structure and bonding, K decreases as the mean atomic weight increases; (4) for a series of minerals which form a binary solid solution, K has a minimum at an intermediate composition; and (5) the K of silicates is related linearly to elastic wave velocities. —Authors' abstract

05159 **Hornbrook, E. H. W.** A Pilot Project at the Silvermine lead deposit, Cape Breton Island, Nova Scotia, Sec. G *in* Progress report on biogeochemical research at the Geological Survey of Canada, 1963-1966: Canada Geol. Survey Paper 67-23, pt. 2, p. 65-94, illus., table, 1969.

Advantages and disadvantages of the Silvermine lead deposit for biogeochemical research are listed. In analyses of 494 samples from 44 trees and 45 soil pits, spectrographic methods provided 4,050 single-element determinations for organic soil and plant material, and colorimetric methods 1,468. Results were brought together on scan sheets for comparison. The magnitude and pattern of anomalies in all plant organs for nine elements were compared to find the most effective one for lead response; different samples from the same organ were also compared. The complex glacial history in the Salmon River valley was a major difficulty in interpretation of sources of anomalies. A project including drilling would resolve many of the difficulties encountered. Bark provided a more reliable basis for interpretation than twigs. Barium can be used as a pathfinder element. — ESL

Hornbrook, E. H. W. *See* Fortescue, J. A. C. 05161

Hostetler, P. B. *See* Hemley, J. J. 05294

05436 **Houston, William N.; Mitchell, James K.** Property interrelationships in sensitive clays: Am. Soc. Civil Engineers Proc., v. 95, paper 6666, Jour. Soil Mechanics and Found. Div., no. SM4, p. 1037-1062, illus., 1969.

The general properties of sensitive clays fit a pattern which is predictable using basic concepts concerning the influence of effective stress and void ratio on volume change tendencies during shear. The low strain-at-failure, low c/p ratio, relatively low strength, and high pore pressure parameter of sensitive clays are due to their tendency to contract during shear. Sensitivity was found to increase in a consistent manner with increasing liquidity index and increasing effective stress. By using liquidity index as a normalized water content, it was possible to develop a general relationship between sensitivity, effective stress, and liquidity index that is applicable both to natural deposits of clay in the field and to laboratory-prepared soils. — ASCE abstract

Houston, William N. *See* Mitchell, James K. 05508

05034 **Howard, James D.; Lohrengel, C. Frederick, 2d.** Large non-tectonic deformational structures from Upper Cretaceous rocks of Utah: Jour. Sed. Petrology, v. 39, no. 3, p. 1032-1039, illus., 1969.

Twelve postdepositional, nontectonic pillow-shaped structures, present in the Panther Sandstone Member of the Star Point Formation in east-central Utah, are larger than any previously reported. Six pillows show primary lamination that can be traced along the bottoms and sides. Primary physical and biogenetic structures are preserved in the distorted primary lamination and on the bedding planes. Smaller ball-shaped structures 1 ft to 7 feet in diameter comprise the matrix between and above the large pillows. These were formed from a sandy-silt which was compressed by the subsidence of the pillow structures and flowed as a viscous fluid. Both the balls and the pillows are considered to have formed in place due to a fortuitous set of depositional conditions, which brought together beds of sand and sandy-silt of the proper thickness. —HRC

Howard, James D. *See* Frey, Robert W. 05361

Howie, R. A. *See* Smith, J. V. 05495

05369 **Hoyt, John H.** Late Cenozoic structural movement, northern Florida [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2038, 1969.

Hubert, John F. *See* Knewtson, Stephen L. 05037

Huff, W. D. *See* Bassarab, D. R. 05033

Hughes, E. S. *See* Levin, H. L. 05450

05082 **Hunn, J. D.; Rosenshein, J. S.** Geohydrology and ground-water potential of St. Joseph County, Indiana: Indiana Div. Water Bull. 33, 20 p., illus., tables, geol. map, 1969.

Principal sources of ground water in St. Joseph County are Quaternary unconsolidated rocks that form a single but complex hydrologic system locally more than 450 feet thick; ground-water potential is estimated at 400 mgd of which about 54 mgd is being pumped. Sand and gravel within a unit of the system yields as much as 3,000 gpm in the South Bend-Mishawaka area. The principal aquifer of the county, partly artesian and partly water-table, has a potential yield from natural recharge of 350 mgd; possible yields to wells range from about 25 to more than 3,000 gpm. A silt till, the confining layer for the artesian part of the aquifer, may have as much as 2 million acre-feet of water in storage but production is limited to small zones. —*from* Authors' abstract

05078 **Huntoon, Peter.** Recurrent movements and contrary bending along the West Kaibab fault zone: Plateau, v. 42, no. 2, p. 66-74, illus., 1969.

The West Kaibab fault zone of northern Arizona records three tectonic pulses: (1) Precambrian movements of unknown complexity; (2) Laramide monoclinal flexing, east block down; and (3) post-Laramide faulting, west block down. The several hypotheses of contrary bending that have been applied to the various fault zones of northern Arizona do not appear valid for the West Kaibab faults. Rather, downbending of strata along the West Kaibab structures is interpreted as a Laramide monoclinal system emplaced prior to the faulting. —Author's abstract

05426 **Hutchinson, G. Evelyn.** *Aysheaia* and the general morphology of the Onychophora: Am. Jour. Sci., v. 267, no. 9, p. 1062-1066, illus., 1969.

In spite of some recent contrary opinions, it appears that the head of the Middle Cambrian onychophora *Aysheaia* is equivalent in its segmentation to the embryo of the modern member of the group such as *Peripatopsis capensis*. — Author's abstract

05568 **Hutchison, David Malcolm.** Provenance of sand in the Great Sand Dunes National Monument, Colorado [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 711B, 1969.

Idriss, I. M. *See* Seed, H. Bolton. 05179

Idriss, I. M. *See* Seed, H. Bolton. 05404

Idriss, I. M. *See* Seed, H. Bolton. 05430

05081 **Indiana University; Cincinnati University.** (Sedimentation Seminar). Bethel Sandstone (Mississippian) of western Kentucky and south-central Indiana, a submarine-channel fill: Kentucky Geol. Survey, ser. 10, Rept. Inv. 11, 24 p., illus., tables, 1969.

A narrow, slightly sinuous channel, cut as much as 250 feet into underlying Mississippian carbonates and filled with Bethel sandstone plus limestone and shale, extends over 170 miles across western Kentucky and into south-central Indiana, where the deposit is known as the Ohio River Formation. Stratigraphic relations plus lithology and petrography of the channel fill indicate the deposit was the product of submarine cutting and filling. Generally southwestward orientation and crossbedding suggest the channel may have extended from the Bethel delta southward toward the Ouachita trough as a cratonic shelf channel. Progressive decementation of the deposits are traced updip away from the main Chester outcrop. Where devoid of younger Chester cover, solution of carbonates at the sand base has produced cherty, clayey rubble. Collapse into solution cavities has caused faulting and brecciation of sand. —*from* Authors' abstract

Ingvalson, R. D. *See* Rhoades, J. D. 05282

05422 **Iowa Geological Survey.** Bedrock of Iowa: [Des Moines, Iowa] Iowa Geol. Survey, scale about 1 in. to 40 mi., 1969.

Ivanov, S. S. *See* Grachev, A. F. 05640

Jackson, A. L. *See* Cooper, J. A. 05285

05623 **Jackson, D. E.; Lenz, A. C.** Latest Silurian graptolites from Porcupine River, Yukon Territory [with French abs.], *in* Contributions to Canadian palcontology: Canada Geol. Survey Bull. 182, p. 17-29, illus., tables, 1969.

Some previously unrecorded graptolites are described from a section of the uppermost Road River Formation on Porcupine River. They include *Linograptus posthumus tenuis* Jaeger, *Monograptus* aff. *M. angustidens* Přibyl, *M. bugensius* (Teller), *M. chelmiensis* (Teller), *?M. crinitus* Wood, *M.* aff. *M. kosoviensis* Boucek, and *M. paraformosus* n.sp. These species were collected through approximately 100 feet of section and indicate late Kopaninan ($e\beta^1$) and early Přidolian ($e\beta^2$) ages for the beds. This is the first documentation of faunas of Přidolian age in Canada. Poorly preserved Early Devonian monograptids and abundant tentaculitids are known from rocks higher in the section. — Authors' abstract

Jackson, M. L. *See* Syers, J. K. 05644

05238 **Jackson, S. A.; Fellnsbee, R. E.** The Pine Point lead-zinc deposits, N.W.T., Canada — Introduction and paleoecology of the Presqu'ile reef: Econ. Geology, v. 64, no. 7, p. 711-717, illus., tables, 1969.

The deposits, with known reserves of 42,500,000 tons averaging 7 percent Zn and 2.6 percent Pb, occupy a 20 by 4 mile belt of barrier carbonate reef of Middle Devonian age, separating a northern shale basin from a southern evaporite basin. Sphalerite and galena, mostly deposited in open cavities and vugs, are the only ore minerals; marcasite, pyrite, calcite, and dolomite are the gangue. Dissolution of evaporites apparently played an important role in development of porosity along initial sedimentary trends and solution-prone strata. — WSW

Jamagne, M. *See* Pedro, C. 05649

Jeffrey, Lela M. *See* Rezak, Richard. 05325

05545 **Jobson, Harvey Eugene.** Vertical mass transfer in open channel flow [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 635B, 1969.

05423 **Johannes, W.** An experimental investigation of the system MgO-SiO_2-H_2O-CO_2: Am. Jour. Sci., v. 267, no. 9, p. 1083-1104, illus., table, 1969.

Equilibrium reactions of this system were experimentally investigated at pressures to 7000 bars and temperatures to 660°C. Serpentine can coexist only with a CO_2-poor fluid, and the lower stability limits of forsterite and talc are determined; talc is a metamorphic mineral at high pressures. The upper and lower stability limits of talc + magnesite are also determined and set limits on the temperature of formation of talc-bearing magnesite deposits and magnesite-bearing talc deposits. The conditions of origin for a number of types and specific localities of magnesite deposits are discussed in the light of these experimental studies. — *from* Author's abstract

Johnson, Charles J. *See* Schlanger, Seymour O. 05205

05102 **Johnson, G. Leonard; Schneider, Eric D.** Depositional ridges in the North Atlantic: Earth and Planetary Sci. Letters, v. 6, no. 6, p. 416-422, illus., 1969.

Recent detailed surveys by the U.S. Naval Oceanographic Office have delineated three new sea-floor ridges in the northern Atlantic. It is postulated that these ridges are sedimentary features formed by depositional processes which in turn are controlled by the flow of Norwegian Sea water. —Authors' abstract

Johnson, J. O. *See* Mallory, E. C., Jr. 05452

05612 **Johnson, J. Peter, Jr.** Late glacial origin of the Sandbanks, Webb Bay, Labrador: Canadian Geographer, v. 13, no. 2, p. 99-112, illus., 1969.

The Sandbanks are a terraced complex of glacio-fluvial and glaciomarine deposits. The progress of deglaciation is described as a series of phases, the first of which began as local hills over 700 feet high appeared above the ice sheet; it was characterized by disintegration of two ice sheets. During Phase 2, the first and highest ice-dammed lake formed. Eastward ice marginal flow continued into Phase 3, when a large system of kame terraces, altitude 360 feet, formed beside the receding ice, leading to lower ice-marginal lakes. Phase 4 was dominated by construction of a more extensive system of kame terraces 100 feet lower than those of Phase 3. In Phase 5, meltwater from the ice and runoff from deglaciated highlands filled a large marginal lake, altitude 230 feet, which may have contributed to Port Danvers Run. In Phase 6, eustatically rising sea level reached part of the Sandbanks. A terrace at 135 feet is believed to be the upper marine limit. — ESL

Johnson, Johnnie. *See* Gotautas, Vito A. 05365

05231 **Johnson, LeRoy, Jr.** Obsidian hydration rate for the Klamath Basin of California and Oregon: Science, v. 165, no. 3900, p. 1354-1355, illus., table, 1969.

A hydration rate for obsidian of 3.5 microns squared per 1,000 radiocarbon years has been established at the Nightfire Island archeological site in northern California and provides a means to date other prehistoric Klamath Basin sites. The new rate follows the form of the hydration equation formulated by Friedman and helps to refute claims made for other hydration equations. —Author's abstract

Jones, Robert L. *See* Ahmad, N. 05262

Jovanovic, S. *See* Reed, G. W. 05089

Judge, A. S. *See* Beck, A. E. 05503

05058 **Jungerius, P. D.** Soil evidence of postglacial tree line fluctuations in the Cypress Hills area, Alberta, Canada: Arctic and Alpine Research, v. 1, no. 4, p. 235-246, illus., table, 1969.

Soil evidence in the Cypress Hills suggests that the tree line has advanced beyond its present position several times since the Wisconsin glaciation. The first and major of these events extended from about 4,500 to 3,600 years BP. The tree line fluctuations, which are presumably due to climatic changes, are recorded in polygenetic soil profiles on erosional sites, and in a sequence of buried soils on depositional sites. —Author's abstract

05178 **Kaarsberg, Ernest A.; Sturm, R. G.** Full scale simulation of earthquake effects on structures in situ [abs.]: Earthquake Notes, v. 40, no. 2, p. 16, 1969.

Kaiserman, A. *See* Shainberg, I. 05598

05280 **Kallio, Arvo; Rieger, Samuel.** Recession of permafrost in a cultivated soil of interior Alaska: Soil Sci. Soc. America Proc., v. 33, no. 3, p. 430-432, illus., tables, 1969.

Soil temperatures above and within the perennially frozen zones of Tanana silt loam, a member of the subgroup of Pergelic Cryaquepts, were measured twice weekly over a period of 3 years in undisturbed, cleared, perennial grass, and potato (*Solanum tuberosum L.*) plots. The permafrost table receded rapidly from a depth of about 1 m to almost 5 m after clearing. Refreezing in autumn and winter takes place simultaneously downward from the surface and upward from the new permafrost table. In the potato plot, an unfrozen zone remained throughout the winter. Mean annual temperatures above the new permafrost table are warmer than 0°C. Some revision in the definition of Pergelic subgroups in the Comprehensive Classification System seems necessary to avoid a change in classification of the soil as a result of clearing and cropping. —Authors' abstract

Kapoor, B. S. *See* Mitra, R. P. 05669

Karasik, A. M. *See* Grachev, A. F. 05640

05079 **Karklins, Olgerts L.** The cryptostome Bryozoa from the Middle Ordovician Decorah Shale, Minnesota: Minnesota Geol. Survey Spec. Pub. Ser. SP-6, 121 p., illus., tables, 1969.

Cryptostome Bryozoa are described and classified by a new interpretation of zoarial structures, emphasizing the dark boundary zones and their spatial arrangement as distinct morphological features in genera of Rhinidyctyidae, Stictoporellidae, and Ptilodictyidae. Sixteen species, of six genera, are described, including *Stictopora lita*, n.sp. On the basis of boundary zones, two new genera *Astreptodictya* and *Anthrophragma*, are proposed, with type species from *Pachydictya*. *Stictopora*, *Escharopora*, and *Graptodictya* are emended. The informal structural groups of Phillips (1960) are redefined and the additional stictoporellid, athrophragmid, and astreptodictyid groups are proposed. The Decorah Shale is divided into three cryptostome zones, with three, one, and two restricted species, respectively. —VMJ

05080 **Karup-Möller, S.** Xonotlite-, pectolite- and natrolite-bearing fracture veins in volcanic rocks from Nûgssuaq, West Greenland: Medd. Grönland, v. 186, no. 2, 21 p., illus., 1969; *reprinted as* Grönlands Geol. Undersögelse Bull. 80, 1969.

Fracture veins containing calc-silicate and zeolite minerals are developed in tuff, pillow lava and olivine basalts from the West Greenland basaltic province. The minerals in the veins can be grouped into three distinct suites, each characterized by one dominant mineral: xonotlite, pectolite and natrolite. The suites are developed at different horizons in the volcanic sequence, the lowest being the xonotlite suite, followed by the pectolite suite and uppermost, the natrolite suite. The mineral suites are believed to have been formed from hydrothermal solutions, at around 300°C and at pressures less than 300 bars, and possibly of magmatic origin mixed with percolating sea water. The suites crystallized in systems at equilibrium under temperature conditions corresponding to the upper zeolite and lower greenschist metamorphic facies. —*from* Author's abstract

Kaye, J. H. *See* Rancitelli, L. A. 05521

Keeping, C. *See* Roy, J. L. 05276

Kell, Klaus. *See* Moore, Carlton B. 05101

05405 **Keller, George H.** Engineering properties of some sea-floor deposits: Am. Soc. Civil Engineers Proc., v. 95, paper 6907, Jour. Soil Mechanics and Found. Div., no. SM6, p. 1379-1392, illus., 1969.

Measurement of mass physical properties such as wet density, shear strength, water content, and grain size have been made on a large number of sediment cores collected from North Atlantic and North Pacific Ocean basins. Some degree of correlation is found between these properties and sediment type, currents, and local topography. Deep-sea floor areas consisting of 'red clay' commonly display lower shear strengths and bulk densities than those blanketed by calcareous oozes. Near continental margins, mass physical properties vary considerably as sediment supply and depositional environment change. Sediments from carbonate environments or areas of relatively high relief normally have higher shear strengths. This investigation gives an indication of the range of these parameters for submarine sediments. — *from* ASCE abstract

05446 **Kelley, Dana R.; McGlade, William G.** Medina and Oriskany production along the shore of Lake Erie, Pierce field, Erie County, Pennsylvania: Pennsylvania Geol. Survey, 4th ser., Bull. M 60 (Mineral Resources Rept.), 38 p., illus., 1969.

Gas production of the Pierce field is from a northward trending belt of well-developed, multiple, fine-grained Lower Silurian Medina reservoir sandstones, and a similar trending belt of medium-grained, Lower Devonian middle Oriskany Sandstone; both horizons appear to represent strandline beach and/or bar deposits. The Medina pool is a stratigraphic trap; productive capabilities of the reservoir reflect the shale-free and porous character of the sandstones. The Oriskany pool is a structural-stratigraphic trap in which limits of production are controlled by distribution of reservoir sandstone and structural closure. The Oriskany is the more profitable horizon although areal extent of gas accumulation is considerably less than that of the Medina. Other horizons, although not evaluated to date, offer potential for future discovery of new gas reserves.—*from* Authors' abstract

05480 **Kelley, J. C.; McManus, D. A.** Optimizing sediment sampling plans: Marine Geology, v. 7, no. 5, p. 465-471, illus., table, 1969.

Sediment sampling at sea is a costly undertaking and inefficiency and redundancy must be minimized. Conversely, it is essential that the sampling density is high enough to obtain sufficiently reliable estimates of the variables of interest. In order to formalize these goals, an analysis of nine textural variables measured on samples from 450 stations on the continental shelf was made. A criterion for sufficient reliability was determined and optimal sampling plans were derived on the basis of this criterion. In an example of the analysis on one of the variables, mean phi size, the results indicate that even with optimal allocation of effort, much more extensive sampling is required for the resolution usually sought. — Authors' summary

05096 **Kelley, James C.; Whetten, John T.** Quantitative statistical analyses of Columbia River sediment samples: Jour. Sed. Petrology, v. 39, no. 3, p. 1167-1173, illus., 1969.

Sediment samples from the Columbia River were analyzed for four variable sets: bulk chemistry, trace-element chemistry, bulk mineralogy, and heavy mineral content. The variable sets were analyzed by discriminant function analysis and factor analysis to determine the relationships between samples in Columbia River reservoirs as reflected in their distribution in the variable space. Other statistical studies were made to determine the relationships among the variables and changes in the variables related to position in the river and grain size. The distribution of the samples in the variable space indicates changes in the sediment which can be related to changing source areas. —Authors' abstract

Kemper, W. D. *See* O'Connor, G. A. 05281

05149 **Kerrick, Derrill Maylon.** Pt. 1, Experiments on the stability of andalusite; Pt. 2, Studies of contact metamorphism in the Sierra Nevada, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1201B-1202B, 1969.

05482 **Kesling, Robert V.; Sigler, James P.** *Cunctocrinus*, a new Middle Devonian calceocrinid crinoid from the Silica Shale of Ohio: Michigan Univ. Mus. Paleontology Contr., v. 22, no. 24, p. 339-360, illus., tables, 1969.

The only calceocrinid crinoid yet discovered in the much studied Silica Shale belongs to the new genus. It differs from the contemporary *Halysiocrinus* in having the A-ray radial fused with the B-ray inferradial on one side and the D-ray radial fused with the C-ray inferradial on the other side, so that the two resultant plates encircle the calyx. Our study shows that the same arrangement is present in *Senariocrinus*, a drastic new interpretation of calyx plates in that genus. From numerical cladistic procedures, a new evolutionary tree of the Calceocrinidae is proposed. Functional studies of morphology in *Cunctocrinus* and other calceocrinids support Jaekel's contention that the advanced genera lived with the column horizontal and elevated the upper part of the crown to a feeding position by a hinge between basals and radials. — Authors' abstract

05483 **Kesling, Robert V.** Growth patterns in *Proctothylacocrinus longus* Kier: Michigan Univ. Mus. Paleontology Contr., v. 22, no. 22, p. 313-322, illus., tables, 1969.

In thirteen selected specimens of *Proctothylacocrinus longus* Kier, growth of individual calyx plates was measured by constant differential growth ratios of width, height, and width × height compared with the average width of BB plates. These ratios show distinct changes in growth rate between the smaller five and the larger eight specimens; the changes are considered to mark the boundary between early ontogeny (probably juveniles) and late ontogeny (probably adults). When values are plotted and contoured on plate diagrams of the species, growth patterns of width, height, and area are graphically shown for the two ontogenetic stages. — Author's abstract

05569 **Khawaja, Ikram Ullah.** Distribution, association and rate of oxidation of iron sulfide in Springfield Coal Member (V) of Petersburg Formation in Sullivan County, Indiana [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 710B-711B, 1969.

Kiefer, Fred W. *See* Seed, H. Bolton. 05430

05131 **Kiefer, Fred William, Jr.** Influence of soil conditions on ground response during earthquakes [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1115B, 1969.

Kim, J. S. *See* Christensen, R. W. 05470

05115 **Kimura, Shigeyuki.** Phase equilibria at liquidus temperatures in the system Ca-Fe-Ti-O [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1024B-1025B, 1969.

05188 **King, Chi-Yu.** Source moment of the Parkfield-Cholame, California, earthquake sequence [abs.]: Earthquake Notes, v. 40, no. 2, p. 22, 1969.

05060 **King, Cuchlaine A. M.** Moraine types on Henry Kater Peninsula, east Baffin Island, N.W.T., Canada: Arctic and Alpine Research, v. 1, no. 4, p. 289-294, illus., tables, 1969.

Field observations of the morphology, till fabric, and stone roundness of moraines on Henry Kater Peninsula, Baffin Island, are analyzed. Several groups of moraines are differentiated by the analysis, which throws light on the method of moraine formation. Outer coast moraines include some of submarine origin which consist of stratified shell-bearing sediments overlain by a thin layer of relatively round stones. Some embayment moraines are smooth and massive, their smoothness due to inclusion of a considerable amount of fine material, which has resulted in active solifluction; some moraines of this type are also found at greater elevations on the outer coast. Moraines of the mountain valleys vary in size according to presence or absence of an ice core.—*from* Author's abstract and conclusions

King, Robert U. *See* Voegeli, Paul T., Sr. 05440

05666 **Kissel, D. E.; Thomas, G. W.** Conductimetric titrations with $Ca(OH)_2$ to estimate the neutral salt replaceable and total soil acidity: Soil Sci., v. 108, no. 3, p. 177-179, illus., 1969.

The conductimetric titration of acid soils with $Ca(OH)_2$ gives a reasonable and rapid estimation of both exchangeable Al^{+3} and total acidity. Na(OH) titration gives low values and does not discern Al^{+3}. KCl estimations of exchangeable acidity tend to be too high due both to hydrolysis and over-titration to reach the phenolphthalein endpoint. — JWH

05037 **Knewtson, Stephen L.; Hubert, John F.** Dispersal patterns and diagenesis of oolitic calcarenites in the Ste. Genevieve Limestone (Mississippian), Missouri: Jour. Sed. Petrology, v. 39, no. 3, p. 954-968, illus., 1969.

Oölitic calcarenites of this formation were deposited in shallow water along the southwestern margin of the Illinois Basin northeast of the Ozark Shoal. Considerable divergence in shelf current patterns is indicated by the large variance for azimuths of cross-bed sets of oölitic calcarenites and by outcrop polymodal windrose diagrams. Tidal currents are also identifiable. During early diagenesis, aragonite was dissolved by the low-Mg water to form extensive moldic porosity within insoluble micrite envelopes. The porosity was later filled with mosaic calcite cement. Oöids with calcite spar interiors and off-center nuclei are thought to reflect the sequence: (1) solution of aragonitic oöid laminae within an insoluble micritic envelope; (2) gravitative settling of the nucleus to the bottom of the mold; and (3) filling of the mold by calcite cement that displaced the nucleus to a nongeopetal position. —*from* Authors' abstract

Kohman, T. P. *See* Ostic, R. G. 05471

Koons, C. B. *See* Rogers, M. A. 05330

05168 **Koopman, F. C.; Trauger, F. D.; Basler, J. A.** Water resources appraisal of the Silver City area, New Mexico: New Mexico State Engineer Tech. Rept. 36, 50 p., illus., tables, 1969.

The towns of Bayard, Central, and Silver City obtain ground water from Quaternary alluvium or from Quaternary and Tertiary Gila Conglomerate. Supplies developed as of 1968 are inadequate to meet demands in Bayard, will become inadequate in Central in 10 years and in Silver City within 20. Populations of the three towns are expected to more than double by the year 2000. Yield from present wells for Bayard cannot be increased appreciably, for Central City and Silver City only to meet demands of the next 10 years; additional wells for Central could be developed to provide water for another five years and for Silver City for the next 20 years, but thereafter well fields would fail rapidly. Large water supplies of suitable quality are

available for development in Gila Conglomerate and bolson fill in parts of the San Vicente Arroyo drainage basin. —*from* Authors' abstract

05531 **Krogh, T. E.; Davis, G. L.** Old isotopic ages in the northwestern Grenville province, Ontario, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 189-192, illus., 1969.

Consistent whole-rock isochrons for ages of about 1700 and 1500 m.y. were obtained from granitic rocks near Georgian Bay, Ontario, 40 and 180 km southeast of the Grenville Front. Geochemical and isotopic characteristics of a paragneiss in the French River area indicate a time of major metamorphism over 1500 m.y. ago. Rb-Sr mineral ages in the three areas were reset by isotopic mixing among coexisting phases between 800 and 1000 m.y. ago. — Authors' abstract

Krouse, H. R. *See* Chrismas, L. 05158

Krouse, H. Roy. *See* Sasaki, Akira. 05239

Kryder, Ralph W. *See* Eggert, Donald A. 05538

05570 **Kulander, Byron Rodney.** A structural analysis of Browns Mountain anticline in West Virginia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 711B, 1969.

Kulm, L. D. *See* Griggs, G. B. 05094

Kumar, Naresh. *See* Friedman, Gerald M. 05031

Kuptsov, V. M. *See* Cherdyntsev, V. V. 05401

05150 **Lajoie, Kenneth Robert.** Late Quaternary stratigraphy and geologic history of Mono Basin, eastern California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1202B, 1969.

05411 **Lam, Peter W. H.** Discussion — [of] "Computer program for plotting beta-diagrams" [by A. B. Spencer and P. S. Clabaugh, 1967]: Am. Jour. Sci., v. 267, no. 9, p. 1114-1117, illus., 1969.

The computer program for fabric diagrams by Spencer and Clabaugh [ibid., v. 265, p. 166-172, 1967] is written mainly for the plotting of B-diagrams only, while beta-diagrams are beyond its scope. However, it is found to be a very efficient and convenient tool in the study of the deformed rocks. On the basis of this subprogram, a computer program for the plotting of beta-diagrams is written in IBM FORTRAN IV language. The first part of the program deals with the computation of vectors derived from the intersecting surfaces, while the latter part, consisting of plotting and counting procedures, is taken from Spencer's subprogram, with some modifications to give a percentage density value in the diagram after being contoured by hand. — *from* Author's introduction

05449 **Lamb, James C.** Planktonic foraminiferal datums and late Neogene epoch boundaries in Mediterranean, Caribbean, and Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2038-2039, 1969.

Landergren, Sture. *See* Carvajal, Marta Campa. 05307

Lanphere, M. A. *See* Fyfe, W. S. 05469

Larner, Kenneth L. *See* Aki, Keiiti. 05195

Larochelle, A. *See* Currie, K. L. 05088

05303 **Larochelle, A.** Preliminary results of a study of the paleomagnetism of the Sudbury irruptive: Canada Geol. Survey Paper 69-19, 23 p., illus., tables, 1969.

Measurements were obtained from 265 cores drilled at 74 norite sites and 197 drilled at 55 micropegmatite sites. After elimination of unreliable data, the remaining directions of magnetization, following cleaning, were analyzed quantitatively and in terms of the geologic context. Low angular dispersion of directions within large sectors of the irruptive and their remarkably high stability suggest that the magnetization measured is predominantly primary and of thermoremanent origin. Statistical analysis shows that mean directions of magnetization of norite and micropegmatite are alike in undisturbed sectors, suggesting that the units are contemporaneous. The low angular dispersion along profiles across the irruptive suggests that it either cooled rapidly or the paleomagnetic field was more stable than at present. Data reported here were combined with that previously reported. — *from* Author's abstract

05477 **Larson, Edwin E.; Mutschler, Felix E.; Brinkworth, George L.** Paleocene virtual geomagnetic poles determined from volcanic rocks near Golden, Colorado: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 29-32, illus., table, 1969.

Three flat-lying basalt flows near Golden, Colorado dated at about 58 m.y. by K-Ar methods have a stable thermoremanent magnetization. The virtual geomagnetic pole position after AC cleaning is located at 81.4° N., 63.7° E. for the upper two flows and 64.5° N., 62.9° E. for the lowest flow. These poles are comparatively close to previously reported early Tertiary pole positions from North America (exclusive of the Siletz River Volcanics pole). Magnetic stability of the samples is directly related to the degree of high-temperature oxidation of opaque minerals. — Authors' abstract

Lattimore, R. K. *See* Weeks, L. A. 05335

05496 **Laurencich, Laura Anna.** Some Ostracoda from the Alazán Formation, Mexico: Micropaleontology, v. 15, no. 4, p. 493-503, illus., table, 1969.

An ostracode fauna of 38 species, many of them too few or too poorly preserved for complete identification, is recorded from the Oligocene Alazán and Huasteca Formations of the Tampico Embayment of Mexico. A new species of *Cytheropteron* is described. — Author's abstract

05419 **Leaming, S. P.; Armstrong, J. E.** Surficial geology, Prince George, British Columbia: Canada Geol. Survey Prelim. Ser. Map 3-1969, scale 1:250,000, text, 1969.

Surficial deposits include: sand and/or gravel, ablation till, colluvium, terraces, rill deposits, till, and fractional units (less than 5 feet in thickness). — MCM

Lee, Clyde. *See* Gotautas, Vito A. 05365

Lee, Kenneth L. *See* Seed, H. Bolton. 05404

05502 **Lee, Kenneth L.; Seed, H. Bolton.** Drained strength characteristics of sands — Closure [to discussions of paper 5561, 1967]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM5, p. 1261-1262, 1969.

In the original paper (ibid., v. 93, no. SM6, p. 117-141, 1967) "critical void ratio" was used as a factor in relating drained and undrained strength of saturated sand. As Rowe and Barden point out (ibid., v. 95, no. SM1, p. 353-359, 1969), there are several definitions of this term, and it has been used recently in defining fundamental stress-strain laws for soil; careful definitions should be given with its use. Their theoretical explanations for differing values of special friction angles determined from drained and undrained tests contribute to understanding of properties of granular materials, but choice of method is of secondary importance to confining pressures in saturated granular soils. As for Marsal's suggestion (ibid., v. 95, no. SM1, p. 349-352, 1969) of basing determination of shear strength on interparticle sliding friction, it may be some time before this approach can be applied quantitatively to cohesionless soils. — GDC

Lent, Robert E. *See* Henke, Burton L. 05270

Lenz, A. C. *See* Jackson, D. E. 05623

05571 **Leonard, Arnold David.** The petrology and stratigraphy of Upper Mississippian Greenbrier Limestones of eastern West Virginia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 711B-712B, 1969.

05157 **Lepeltier, Claude.** A simplified statistical treatment of geochemical data by graphical representation: Econ. Geology, v. 64, no. 5, p. 538-550, illus., 1969.

In the analysis of 25,000 measurements of Cu, Pb, Zn, and Mo in a geochemical survey of Guatemalan stream sediments, estimates of background, coefficients of deviation, and threshold levels were facilitated by the use of log-probability graph paper. —WSW

Letey, J. *See* Watson, C. L. 05660

05338 **Leutze, W. P.** Significance of Pliocene stratigraphic paleontology, Gulf Coast [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2039, 1969.

05339 **Levert, Charles F., Jr.; Ferguson, Hershal C., Jr.** Geology of West Flower Garden bank, northwest Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2039, 1969.

05450 **Levin, H. L.; Echols, D. J.; Thompson, D. J.; Hughes, E. S.** Some comparisons of Neogene microbiostratigraphy in offshore Louisiana and Blake Plateau [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2039, 1969.

Levorson, C. O. *See* Strimple, Harrell L. 05066

Levy, Michael A. *See* Pomeroy, Paul W. 05172

05022 **Lewis, Standley E.** Fossil insects of the Latah Formation (Miocene) of eastern Washington and northern Idaho: Northwest Sci., v. 43, no. 3, p. 99-115, illus., 1969.

From the Latah Formations at two localities near Spokane, Wash., and one near Juliaetta, Idaho, 15 new species of insects are described and figured. The insects are preserved as carbonized impressions, usually of wings only, in the clayey sediments of fresh-water origin. The orders Plecoptera, Homoptera, Psocoptera, Lepidoptera, Mecoptera(?), and Diptera are represented in the fauna for the first time; Odonata, Isoptera, Hemiptera, Hymenoptera, Coleoptera, and Trichoptera were found previously and also in this study. Of particular note are discoveries of a stonefly, *Megaleuctra jewetti*, apparently the first plecopteran described from the Miocene of North America, and nine species representing six lower families of Diptera. —VMJ

05465 **Liebermann, Robert C.; Schreiber, Edward.** Critical thermal gradients in the mantle: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 77-81, table, 1969.

Critical thermal gradients based upon ultrasonic laboratory data for a great variety of minerals confirm that it is possible to have a low-velocity layer for shear waves without requiring one for compressional waves. The discovery that the shear wave velocity decreases with increasing pressure for trevorite ($NiFe_2O_4$), which crystallizes in the spinel structure, together with the previously reported low-pressure derivative of the shear wave velocity in magnesium-aluminate spinel, supports the conclusion that shear velocity may decrease with depth in the transition region of the mantle. Low values of the critical thermal gradient for shear waves are the consequence of low values of the pressure derivative of the isotropic shear modulus (μ). This derivative, $(\delta\mu/\delta P)_T$, is determined by Poisson's ratio and the coordination of ions in the crystallographic lattice. — *from* Authors' abstract

05389 **Linchenat, A.; Shirokova, I.** Individual characteristics of the nickeliferous iron (laterite) deposits of the northeastern part of Cuba (Pinares de Mayari, Nicaro and Moa) *in* Internat. Geol. Cong., 22d, New Delhi, 1964, Proc., Sec. 14, Laterites: Calcutta, India, Internat. Geol. Cong., 22d, Organising Comm., p. 171-187, illus., tables, 1964 [1969].

The three deposits in question were formed by weathering of the same massif of serpentinized ultramafic rocks, on peneplanes of different altitudes. Geological and geomorphic factors, analyzed here, can account for differences between the three. Total reserves are estimated as 489 million metric tons of iron ore, 9,330 thousand metric tons of nickel, and 933 thousand metric tons of cobalt. — DBV

Link, J. M. *See* Saum, N. M. 05509

05577 **Lintz, Joseph, Jr.** Tenth day — Ely-Eagle Springs, Lunar Crater-Hot Springs valley — Eureka, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 10/1-10/13, illus., 1969.

This one-day field trip begins in Ely and ends in Eureka, Nev., is 279 miles long, and makes 7 stops, each of which is described briefly. Geological observations along the way are included also. The stops examine Paleozoic sedimentary rocks, and Tertiary volcanic and sedimentary rocks, the Faultless atomic blast crater, and some Recent volcanic craters. — HRC

05582 **Lintz, Joseph, Jr.** (leader). Geological road log, Reno-Carson City-Stateline-Tahoe City-Truckee-Reno, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. [15/1-15/16], illus., 1969.

This is a road log for a one-day field trip into the Sierra Nevada from Reno, Nev. Seven stops are made in the 157-mile trip. Numerous geological features in the Sierra Nevada are visited, including hot springs, glacial features, landslides, etc. Geological observations enroute are included. — HRC

05590 **Lintz, Joseph, Jr.** Sixth day — Aerial reconnaissance of a portion of the Basin and Range Province, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 6/1-6/6, illus., 1969.

This is a generalized description of geologic features to be seen on an airplane trip from Las Vegas, Nev., to Mount Whitney, Death Valley, Inyokern, and Daggett, Calif., and the Grand Canyon and the Wasatch Front at Salt Lake City, Utah, where the trip ends. Various geomorphic and stratigraphic features are discussed, as are obvious structural features, all of which can be seen from the air. — HRC

05604 **Lintz, Joseph, Jr.** (editor). Second Basin and Range geology field conference, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, sections paged separately, illus., tables, 1969.

This guidebook, for the second field conference, contains road logs and general geological descriptions of the region around Las Vegas, Nevada, Salt Lake City, Utah, and Nevada in general. Each trip is cited separately by author. — HRC

05289 **Little, H. W.** Anhydrite-pegmatite uranium ore at Bancroft, Ontario: Econ. Geology, v. 64, no. 6, p. 691-693, table, 1969.

Anhydrite pods and dikes up to 40 feet wide locally contain sufficient uranium to constitute ore. The anhydrite grades into pegmatite, and crystallized earlier than the latest of the pegmatite minerals. Within the limits of experimental error, Pb/U and Pb/Th ratios indicate that uraninite in anhydrite is contemporaneous with that in pegmatite (1,000-1,100 m.y.). The anhydrite is believed to have formed by partial to almost complete fractionation of the primary pegmatite magma. —WSW

Lloyd, R. Michael. *See* Shinn, Eugene A. 05099

05151 **Lofgren, Gary Ernest.** Experimental devitrification of rhyolite glass [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1202B-1203B, 1969.

Lohrengel, C. Frederick, 2d. *See* Howard, James D. 05034

05591 **Longwell, C. R.** Third day — Keystone thrust, Frenchman Mountain, Dry Lake Range, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 3/11-3/17, illus., 1969.

This field trip which begins and ends in Las Vegas, Nevada, is 92 miles long and makes 8 stops, each of which is described. No geologic data enroute are included, however. Various places where evidence for the faulting exists are visited. — HRC

05592 **Longwell, C. R.** Fourth day—Spring Mountains, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 4/1-4/5, illus., 1969.

This field trip road log covers a one-day trip starting and ending in Las Vegas, Nevada; the trip is 106 miles long and makes thirteen stops. Paleozoic and Cenozoic rocks are visited, as are numerous overthrust faults. Each stop is described but no account of the geology enroute is included. — HRC

05605 **Longwell, C. R.** Third and fourth days—Ranges bordering Las Vegas Valley, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 3/1-3/10, illus., 1969.

A generalized description of the region is given. Rocks of Precambrian, Paleozoic, Mesozoic, and Tertiary age are present; the sedimentary rocks, totaling over 28,000 feet, thicken toward the west. A structural shear zone transects the region from northwest to southeast, and numerous thrust faults are present. This description is followed by a road log for a two day field trip in the area. — HRC

Lopez, P. L. *See* Graham, E. R. 05662

05041 **Lovell, J. P. B.** Tyee Formation—A study of proximality in turbidites: Jour. Sed. Petrology, v. 39, no. 3, p. 935-953, illus., tables, 1969.

The paleogeographic significance of lateral variations in turbidite sandstones of the middle Eocene Tyee Formation of the Oregon Coast Range is assessed. The clearest trends in the turbidites are a distal decrease in the sandstone-shale ratio, and a distal increase in the proportions of sharp sandstone bases and relatively light, nonspherical heavy minerals. Other indicators are also present. Some of these may be used in deformed or metamorphosed turbidites to determine the paleogeography. Use of the specific values from the Tyee in turbidite sequences in general would be premature; one cannot yet say whether or not the indicators of "proximality" have an absolute value. It is suggested that a comparison of rates of change in the indicators away from the place of origin of turbidity currents in various turbidite sequences might yield significant results. —*from* Author's abstract

05249 **Lovering, T. S.** The origin of hydrothermal and low temperature dolomite: Econ. Geology, v. 64, no. 7, p. 743-754, illus., 1969.

Laboratory and field data provide the basis for a chart showing the stability fields of calcite and dolomite in dilute solutions as a function of temperature and Ca/Mg molar ratios. In some areas the Ca/Mg ratios of present ground water are such that they would convert limestone to dolomite if they were heated, as by shallow intrusives. The early pre-ore age of most hydrothermal dolomite is attributed to the heat accompanying the initial rise of magma. Observed differences in amount of dolomite, despite similarity of ores, is readily explained if ground water, rather than magmatic fluid, is the source of Mg. — WSW

05312 **Lowman, P. D., Jr.** Geologic orbital photography — Experience from the Gemini program: Photogrammetria, v. 24, nos. 3-4, p. 77-106, illus., tables, 1969.

Most Gemini flights carried a terrain photography experiment whose objective was to obtain small-scale color photographs of selected land and ocean areas; nearly 1,100 usable pictures were returned. Specific geologic applications include: study and remapping of part of northern Baja California, Mexico, near the Agua Blanca fault;

study of tectonics and geology of the Palomas area, Chihuahua; unsuccessful search for the Texas lineament; and two studies in Chad and Libya, and the Arabian Sea. Advantages and disadvantages of orbital photography are discussed, and it is concluded that the geologic value and feasibility have been demonstrated. — ESL

Loy, Teresita A. *See* Ponnamperuma, F. N. 05659

05156 **Lusk, John.** Base-metal zoning in the Heath Steele B-1 orebody, New Brunswick, Canada: Econ. Geology, v. 64, no. 5, p. 509-518, illus., tables, 1969.

Mineral zoning from footwall to hanging wall is characterized by decrease in Cu, moderate increase in Pb and Ag, and large increase in Zn. Within any bed, the maximum concentrations of Zn, Pb, and Ag occur at two principal centers, whereas Cu increases away from these centers. "Both types of zoning are attributed to a volcanic-exhalative origin on the basis of consistent relationships between the character of across-layer zoning and stratigraphy, and geometrical features of the lateral zoning." The lateral zoning differs from that in typical vein deposits. —WSW

05028 **Lyall, Anil; Shearer, James.** Recognizing fossil strand lines from grain-size analysis —Comment on a paper by John Chappell [1967]: Jour. Sed. Petrology, v. 39, no. 3, p. 1254-1255, illus., table, 1969.

A discrepancy between the standard probability scale and the probability scale used by Chappell (ibid., v. 37, p. 157-165, 1967) is noted. The two are illustrated side by side and the differences in the measurements are evident. Consequently, certain values obtained by Chappell with the use of his scale are inaccurate; corrections are given. —HRC

05572 **Lydon, Philip Andrew.** Geology of the Butt Mountain area, a source of the Tuscan Formation in northern California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 712B, 1969.

MacFarlane, I. C. *See* Forrest, J. B. 05434

Macintyre, R. M. *See* York, Derek. 05476

05554 **Mack, Hafry.** The nature of short period P wave signal variations at LASA [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 716B, 1969.

05032 **Madole, Richard F.** Pinedale and Bull Lake glaciation in upper St. Vrain drainage basin, Boulder County, Colorado: Arctic and Alpine Research, v. 1, no. 4, p. 279-287, illus., 1969.

Bull Lake glaciers advanced 14 to 15 km from the cirque area depositing till exposed mainly in narrow belts around the Pinedale till margin. Two Bull Lake stades are recognized; the till generally lacks morainal topography and is more weathered and eroded than the Pinedale. During Bull Lake-Pinedale interglacial time, a soil 1-2 m thick formed on older till at altitudes up to 3,000 m. Pinedale till, covering 90 percent of the glaciated area, is characterized by rugged topography, prominent moraines, numerous undrained depressions, slight dissection by streams, and is divisible into three stades: early glaciers halted in major valleys at altitudes 2,400 and 2,640 m; middle stade glaciers halted 0-2.5 km within outer limit of early stade; late stade moraines are small, poorly developed and confined within valley walls 3-5.5 km below cirques. —Author's abstract

05186 **Major, M. W.; Romig, P. R.; VanWormer, J. D.** Residual strains associated with a nuclear event [abs.]: Earthquake Notes, v. 40, no. 2, p. 21-22, 1969.

Mallett, Gavin R. *See* Barrett, Charles S. 05268

05452 **Mallory, E. C., Jr.; Johnson, J. O.; Scott, R. C.** Water load of uranium, radium, and gross beta activity at selected gaging stations, water year 1960-61: U.S. Geol. Survey Water-Supply Paper 1535-O, p. O1-O31, illus., tables, 1969.

Water samples were collected from 36 rivers during low, medium, and high flows. The drainage areas above sampling sites represent about 55 percent of continental United States including 86,000 sq mi of Alaska and 155,000 sq mi of Canada. During the 1960-61 water year, the total uranium-solute load ranged from about 100 lb contributed by Nezinscot River to 695,000 lb contributed by the Mississippi. Calculated total uranium-solute load of the rivers sampled was used to estimate that about 2 million lb of uranium was carried in solution from continental United States to the oceans during this year. Calculated radium-solute load for the sampling period ranged from about 2.5×10^{-5} lb for Nezinscot River to $25,000 \times 10^{-5}$ lb for the Mississippi River. The gross solute load of radium for conterminous United States to the oceans for water year 1960-61 was estimated to be about $67,000 \times 10^{-5}$ lb. — Authors' abstract

05114 **Malone, Carl Hubert, Sr.** Labeling of sand particles for sediment transport studies using stable isotopic tracers [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1272B, 1969.

05315 **Manker, J. P.; Griffin, G. M.** Distribution of silicate minerals in Florida Bay [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2039, 1969.

Manker, J. P. *See* Griffin, G. M. 05366

05211 **Manning, P. G.** Optical absorption spectra of chormium-bearing tourmaline, black tourmaline and buergerite: Canadian Mineralogist, v. 10, pt. 1, p. 57-70, illus., tables, 1969.

Polarized absorption spectra are reported of Cr-bearing tourmaline from Kaavi, Finland, two black tourmalines from Villeneuve, Quebec, and Como, Italy, and buergerite from San Luis Potosí, Mexico. Spectra of Cr-bearing tourmaline exhibit two strong absorption bands at 17000 cm^{-1}, characteristic of Cr^{3+}, energy of the former band indicating that Cr^{3+} is located in a 'loose site' in the octahedral sites in the spiral chain. Spectra of black tourmalines consist of bands marking transitions within Fe^{2+} and Fe^{3+} ions; Mn^{3+} may also be present in black tourmalines. Buergerite spectra show bands due to Fe^{2+} in near infrared and red regions, but most features in the visible are swamped by charge-transfer bands. Fe^{2+} is located in Al^{3+} sites in spiral chains of black tourmalines, but mainly in 'brucite units' of buergerite. —*from* Author's abstract

Manuel, O. K. *See* Alexander, E. C., Jr. 05067

05438 **Mapes, B. E.** Sediment transport by streams in the Walla Walla River basin, Washington and Oregon, July 1962-June 1965: U.S. Geol. Survey Water-Supply Paper 1868, 32 p., illus., tables, 1969.

In this eastern 1,760 sq mi basin, Columbia River basalt is thinly covered in the mountainous east by residual soil, with alluvial fans and deep-cut valley fills on slopes; lacustrine deposits in the west are mantled in places by loess, some at least 100 feet thick. Most of the average runoff of about 4.8 inches per year follows winter, on partially frozen ground. In the 3-year study, annual sediment yields per square mile averaged from 420 tons in the mountains to over 4,000 tons in cultivated loessal areas, where the Touchet River and Dry Creek transported 80 percent of the total sediment load discharged from the whole basin. Highest concentrations were from loess in the Dry Creek drainage, a maximum recorded 316,000 mg per liter. Silt predominates in suspended sediment of all streams. Bedload, about 5-12 percent as much as the suspended load in mountain and upland streams, was only 2-8 percent in the lower Walla Walla River and tributaries. — GDC

Mapper, D. *See* Pierce, T. B. 05286

05107 **Marangunić, Čedomir Damianovic.** Effects of a landslide on Sherman Glacier, Alaska [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1210B, 1969.

05574 **Marsell, Ray E.** Geology of the Salt Lake area, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 7/1-7/23, illus., 1969.

This field trip log covers 121 miles; it begins in Salt Lake City and ends in Provo, Utah. Three side trips into canyons in the Wasatch Mountains are made, there being 12 stops in all. Each stop is fully described, and much geological information is included along the route. Paleozoic, Mesozoic and Cenozoic rocks and structures are observed as is the complex geomorphology of the region. — HRC

05317 **Marszalek, Donald S.; Wright, Ramil C.; Hay, William W.** Function of test in Foraminifera [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2040, 1969.

05530 **Martignole, Jacques.** Relations chronologiques et structurales entre la Série de Grenville et la Série de Morin dans le Sud de Québec [with English abs.], *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 183-188, illus., geol. map, 1969.

A structural study of the Grenville series in the Shawinigan area has shown the presence of two major tectonic events separated by the intrusion of a noritic magma (Morin series). The first folds in the Grenville series are overturned to the north; at the same time the gneisses underwent regional anatexis and metamorphism. The norite was emplaced after the first folding; along the contact some relics of a thermal aureole remain. The second folds, with south-southeast plunging axes, appear in the Morin series as open folds; in the Grenville gneisses they are superposed on the first folds as complex basin, dome, and crescent structures, which become more elongated to the south-southeast as the norite is approached and the old east-west structures are obliterated; the norite acted as a rigid buttress to the gneisses during the last folding. — VMJ

05634 **Martin, Gene B.** The subsurface Frio of south Texas — Stratigraphy and depositional environments as related to the occurrence of hydrocarbons [abs.]: South Texas Geol. Soc. Bull. [v. 9, no. 10], p. 2, 1969.

05261 **Martin, R. F.; Piwinskii, A. J.** Experimental data bearing on the movement of iron in an aqueous vapor: Econ. Geology, v. 64, no. 7, p. 798-803, illus., table, 1969.

"Hypersolidus and subsolidus hydrothermal quenching experiments on calc-alkaline plutonic rocks between 1.25 and 10 kb water pressure indicate that iron fractionates into the vapor phase. . . Subsolidus polythermal experiments on andesite and diabase corroborate the movement of iron in the vapor phase and the nucleation of hematite at approximately 500°C." The experimental data help to explain specular hematite incrustations near volcanic vents and the generation of contact-metamorphic iron-ore deposits. —WSW

05111 **Martin, Robert François Churchill.** Hydrothermal synthesis of low albite orthoclase, and non-stoichiometric albite [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1270B, 1969.

05316 **Martinez, Joseph D.** Impact of salt on man's environment [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2039-2040, 1969.

05337 **Mason, B. B.** Possible future petroleum provinces of Western Gulf basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2040, 1969.

05038 **Matalucci, Rudolph V.; Shelton, John W.; Abdel-Hady, M.** Grain orientation in Vicksburg loess: Jour. Sed. Petrology, v. 39, no. 3, p. 909-979, illus., 1969.

The azimuthal preferred grain orientation of Vicksburg and pre-Vicksburg loess, Vicksburg, Mississippi, determined from photomicrographs of thin sections, ranges from 285° to 289° (N. 75° W.-N. 71° W.). Imbrication determined by the same visual method for both materials ranges from 3° to 8°. The azimuthal fabric mean deter-

mined by dielectric anisotropy measurements with a Shell Development Company instrument ranges from 275° to 284° (N. 85° W.-N. 76° W.). Imbrication determined by the same instrument ranges from 4° to 10°. Based on the thinning pattern for loess in this area, a paleowind direction of 290° (N. 70° W.) is ascertained which conforms to the overall average fabric mean of 283° (N. 75° W.). —Authors' abstract

05308 **Matthews, William H., 3d.** The geologic story of Palo Duro Canyon: Texas Univ. Bur. Econ. Geology Guidebook 8, 51 p., illus., 1969.

Palo Duro Canyon, in the High Plains area of the Texas Panhandle, exposes rocks of Permian, Triassic, Tertiary and Quaternary ages. The gypsiferous shaley Quartermaster, the Tecovas shale, massive Trujillo sandstone, and the Pliocene Ogallala Formations are described. Within the Ogallala, capped by caliche, is an important aquifer; overlying it are Pleistocene sediments including wind-blown silt and sand. Palo Duro Canyon is a classic example of an erosional landform created by running water, much of it in flash floods, aided by weathering processes and mass wasting of canyon walls. Man has contributed to natural processes since 10,000 B.C., according to artifacts and mammoth bones found there. Set aside as a State Park, today's visitor can relive some of the fascinating history of the area. — GDC

May, J. *See* Hopkins, E. 05368

Maybank, J. *See* Gendzwill, D. J. 05279

05425 **Mayr, Ernst.** Grundgedanken der Evolutsionsbiologii: Naturwissenschaften, v. 56, no. 8, p. 392-397, 1969.

After a brief description of the essence of modern views on the causality of evolution, an attempt is made to present the conceptual and philosophical bases of the outstanding present theories of evolution. Philosophical problematics, evolution and behavior, the tempo of evolution, and the future teaching of evolution are discussed. Questions that must be answered include: Why have not certain blue-green algae changed noticeably within 1.5 m.y.; why have the faunas of certain geologic periods suffered great catastrophes and why have these catastrophes sometimes occurred simultaneously on land and sea in some periods and independently in others; and what were the special conditions which permitted only a few, out of the possibly more than a billion family lines which have existed on Earth, to evolve into Man?—DBV

05059 **McCann, S. B.; Owens, E. H.** The size and shape of sediments in three arctic beaches, southwest Devon Island, N.W.T., Canada: Arctic and Alpine Research, v. 1, no. 4, p. 267-278, illus., tables, 1969.

The general characteristics of arctic beaches are considered. Sample data on size distribution characteristics and roundness due to abrasion of modern beach material from three beaches in the Cape Ricketts-Radstock Bay area of southwest Devon Island are presented. The area is one of limited wave action due to the inhibiting effects of sea ice. Sorting and roundness values of the beach material provide indirect measures of wave energy and allow comparisons to be made with beaches in other environments. Changes in mean size, sorting and roundness values both along and across the beaches suggest longshore transport by wave action. —Authors' abstract

McClure, Duane A. *See* Rogers, Thomas H. 05386

05494 **McConnell, Duncan; Hey, M. H.** The oxyapatite (voelckerite) problem: Mineralog. Mag., v. 37, no. 286, p. 301-303, 1969.

The question of the existence of vacancies in structural sites that are occupied by F in ordinary $Ca_{10}(PO_4)_6F_2$ is reviewed. The data presented by E. J. Young and E. L. Munson (Am. Mineralogist, v. 51, p. 1476, 1966) afford no acceptable evidence for the existence of apatites with less than 26(O,OH,F,Cl) in the unit cell. —HRC

05050 **McCorkell, R. H.; Fireman, E. L.; D'Amico, J.; Thompson, S. O.** Radioactive isotopes in Hoba West and other iron meteorites: Meteoritics, v. 4, no. 2, p. 113-122, tables, 1969.

The radioactivities of Be-10, Al-26, Cl-36, Mn-53, Ni-59, and Co-60 and the rare gas isotopes were measured in a sample taken from the surface of the Hoba meteorite. The spallation-produced radioactivities indicate that the sample was at a depth of 35 to 40 cm when the body was in space. The Ni-59 activity indicates that the terrestrial age of Hoba is less than 80,000 years. Its Cl-36-Ar-36 exposure age is 263 ± 40 m.y. The Cl-36 and rare-gas isotopes were also measured in the Deelfontein meteorite; its Cl-36-Ar-36 exposure age is 400 ± 40 m.y. The Cl-36 and Ni-59 were also measured in a sample of Sikhote-Alin. In both Hoba and Sikhote-Alin the Ni-59 is higher than would be expected from the Cl-36 content, indicating that solar flares contributed to the neutron-produced isotopes in these iron meteorites. —*from* Authors' abstract

05600 **McCormack, D. E.; Wilding, L. P.** Variation of soil properties within mapping units of soils with contrasting substrata in northwestern Ohio: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 587-593, illus., tables, 1969.

Variation of soil properties within mapping units of selected soils in northwestern Ohio was studied. The soils studied have sandy or loamy upper sola that overlie a fine-textured substratum. The development of the lower B horizons into the fine-textured substratum was not consistently related to mapping units differentiated on that basis. Statistical summaries illustrate the large magnitude of soil variability present in this landscape. — Soil brief

McCormick, J. Edward. *See* Hill, William T. 05229

05555 **McGarr, Arthur Francis.** Transmission and reflection of Rayleigh waves at vertical boundaries and amplitude variations of Rayleigh waves — Propagation across a continental margin [and] horizontal refraction [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 716B-717B, 1969.

05108 **McGinley, John Robert, Jr.** A comparison of observed permanent tilts and strains due to earthquakes with those calculated from displacement dislocations in elastic Earth models [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1210B-1211B, 1969.

McGinnis, Michael R. *See* Strimple, Harrell L. 05020

McGlade, William G. *See* Kelley, Dana R. 05446

05587 **McGregor, D. C.** Devonian plant fossils of the genera *Kryshtofovichia*, *Nikitinsporites*, and *Archaeoperisaccus* [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 91-106, illus., 1969.

The structure and occurrence of dispersed miospores of *Archaeoperisaccus* Naumova, of Devonian age, from Canada and U.S.S.R. show that spores similar to *A. concinnus* Naumova are microspores of *Kryshtofovichia africani* Nikitin, and support Chaloner's proposal that spores referable to Nikitinsporites are megaspores of that plant. The genus *Archaeoperisaccus* is emended. *Kryshtofovichia*, probably of lycopsid affinity, may be a precursor of the Triassic-Jurassic group *Lycostrobus-Cyclostrobus-Pleuromeia*, and possibly of the modern plant *Isoetes*. *Archaeoperisaccus* has considerable promise as an index fossil. — *from* Author's abstract

05234 **McGregor, V. R.** Early Precambrian geology of the Godthaab area, *in* Report of activities, 1968: Grönlands Geol. Undersögelse Rap. 19, p. 28-30, 1969.

The Ameralik dikes can be used to distinguish an old pre-Ameralik dike basement from a post-Ameralik dike cover of supracrustal amphibolites and metasedimentary gneisses, and from granitic rocks (most of which are deformed and recrystallized to gneisses) that intrude and cover the area. The informal name Malene supracrustals is introduced for the younger material. The stratiform anorthosites of the Godthaabs-

fjord area are younger than the dikes and form sheets in the Malene. These are not genetically associated with significant quantities of basic or ultrabasic rocks. Two dates older than 3000 m.y. have been obtained from the Fiskenaesset area, making the Malene rocks about 3100 m.y. and the other materials even older. —HRC

05397 **McGuinness, C. L.** New thrusts in ground water: Ground Water, v. 7, no. 2, p. 7-10, 1969.

Four principal trends in ground water are: increasing use of ground water for domestic supplies, increasing use of aquifers as possible storage media for surplus flood water, possibilities of using saline aquifers as sources of water supply, and use of aquifers as possible storage media for industrial and domestic waste effluents. These trends will require geohydrologists to learn quantitative evaluation of water supply under conditions of maximum development, and to do enough research and experimentation to determine reasonable costs for artificial recharge of aquifers and evaluation of saline aquifers as a resource. To prevent stream pollution, control is needed so effects of waste injection into aquifers can be predicted, a technology can be developed, and a basis for a rational decision of how thus using aquifers is best for future economy. A systems-analysis approach is needed to supply quantitative answers for water planners. — *from* Author's abstract

05384 **McIntosh, Willard L.; Morgan, Ida M.** Geologic map index of Montana, 1955-1967: Washington, D.C., U.S. Geol. Survey, scale 1:1,000,000, 1969.

This is a supplement to the geologic map index published in 1955 (Boardman and Bove); a copy of the earlier edition is included in the map folder. — MCM

05645 **McKeague, J. A.; Saint Arnaud, R. J.** Pedotranslocation — Eluviation-illuviation in soils during the Quaternary: Soil Sci., v. 107, no. 6, p. 428-434, 1969.

Past studies have produced much information on the sequence and magnitude of eluviation and illuviation of substances in various soils during the Quaternary. However, pedology has not reached the stage in which it is possible to predict accurately the translocation of soil constituents under specified conditions. The gains and losses of soil constituents in various horizons are complicated by the difficulty of establishing the original mineralogy of the parent material. — JWH

05184 **McKeown, F. A.** Fault displacements and motion related to nuclear explosions [abs.]: Earthquake Notes, v. 40, no. 2, p. 20-21, 1969.

McKown, D. M. *See* Morgan, J. W. 05487

McLean, E. O. *See* Conyers, E. S. 05594

McManus, D. A. *See* Kelley, J. C. 05480

05318 **McNamee, Donald F.** Lower Cretaceous Glen Rose reef complex of East Texas and central Louisiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2040, 1969.

McNeal, B. L. *See* Watson, C. L. 05660

05377 **Medaris, L. G., Jr.** Partitioning of Fe^{++} and Mg^{++} between coexisting synthetic olivine and orthopyroxene: Am. Jour. Sci., v. 267, no. 8, p. 945-968, illus., tables, 1969.

Comparison of experimental data with published experimental data at liquidus temperatures demonstrates that Fe^{++}-Mg^{++} partitioning between olivine and orthopyroxene is not appreciably temperature-dependent over the interval 900° to 1300°C and possibly over the range 700° to 1300°C. There is close agreement between partitioning determined by experiment and that predicted by cation exchange between an ideal single-site phase (olivine) and a double-site phase (orthopyroxene) in which there is an ideal solution behavior between the sites. Com-

parison of the compositions of these two minerals with the experimental partitioning curve is useful in interpreting whether or not these silicates are in equilibrium. This approach is illustrated with data on olivine-orthopyroxene pairs from chondritic meteorites, stratiform basic intrusives, peridotite nodules, basalt and kimberlite, and alpine peridotites. — *from* Author's abstract

05474 **Meehan, W. R.** Beryllium in six U.S.G.S. standard rocks: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 1-2, tables, 1969.

The Be content of AGV-1, BCR-1, DTS-1, G-2, GSP-1, and PCC-1 was determined by the fluormetric method of Cosgrove. The data are presented in tables in comparison with previously published values. —HRC

05319 **Meisburger, Edward P.; Duane, David B.** Shallow structural characteristics of Florida Atlantic Shelf as revealed by seismic-reflection profiles [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2040, 1969.

05242 **Mellett, James S.** A skull of *Hemipsalodon* (Mammalia, Deltatheridia) from the Clarno Formation of Oregon: Am. Mus. Novitates, no. 2387, 19 p., illus., tables, 1969.

A skull of *Hemipsalodon*, a very large *Pterodon*-like kyaenodontid from the late Eocene Clarno Formation of central Oregon, is described in detail. — KAF

Melson, Willis H. *See* Pierce, William G. 05252

05086 **Menard, H. W.** Elevation and subsidence of oceanic crust: Earth and Planetary Sci. Letters, v. 6, no. 4, p. 275-284, illus., 1969.

A moving oceanic crustal plate is elevated where it is created at the trailing edge and it subsides as it grows older. The rate of subsidence averages 9 cm/10^3 yr for the first ten million years, 3.3 cm/10^3 yr for the next 30 million, and is estimated at 2 cm/10^3 yr for the next 30. Older crust in the Pacific subsided at a slower rate for an additional 25 million years. The rate was faster in the Atlantic for the same period. Subsidence is related to mantle degassing, erosion, sedimentation, mantle counterflow, and sea-floor spreading. "Midplate rises", existing in all major ocean basins, probably mark the locus of small transient convection cells which act under rather than at the edges of large crustal plates. —*from* Author's abstract

Merrill, G. F. *See* Weeks, L. A. 05335

05488 **Mesecar, Roderick S.; Bodvarsson, Gunnar; Burt, Wayne V.** Time-dependent vertical temperature measurements across the water-sediment interface on the continental shelf west of Oregon: Nature, v. 224, no. 5222, p. 901-902, illus., 1969.

A thermoprobe capable of measuring temperatures both 2.5 m into the sediment and in the water up to 3.3 m above the sediment has been designed, constructed, and used to monitor temperatures across the water-sediment interface at oceanic stations west of Oregon. Pronounced diurnal and semidiurnal frequencies in the water temperature are observed. — DBV

Meyer, F. P. *See* Gazzara, C. P. 05269

05573 **Mifflin, Martin David.** Delineation of ground-water flow systems in Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 712B-713B, 1969.

Migliaccio, Ralph R. *See* Ross, Grant A. 05435

05251 **Miller, C. H.; Bath, G. D.** Gravity map of Amchitka and nearby islands, Alaska: U.S. Geol. Survey Geophys. Inv. Map GP-693, scale 1:250,000, 1969.

05420 **Miller, F. K.** Preliminary geologic map of the Loon Lake quadrangle, Stevens and Spokane Counties, Washington: Washington Div. Mines and Geology Geol. Map GM-6, scale 1:62,500, sections, 1969.

05557 **Miller, Lee Durward.** Steaming and warm ground in Yellowstone National Park—Their location, geophysics, vegetation and mapping with aerial multispectral imagery [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 456B-457B, 1969.

05290 **Miller, Ralph L.** Pennsylvanian formations of southwest Virginia: U.S. Geol. Survey Bull. 1280, 62 p., illus., tables, geol. map, 1969.

In 1893, Marius R. Campbell divided the rocks of Pennsylvanian age in southwest Virginia into five formations: Lee Conglomerate, Norton Formation, Gladeville Sandstone, Wise Formation, and Harlan Sandstone, but he published a type section only for the Lee. This paper describes the formations, presents the Lee type section in more detail, and installs type sections for the Norton, Gladeville, and Wise. An appropriate section was not found for the Harlan. Because the lithology of the Gladeville is not distinctive and because structure involving the Gladeville has been misinterpreted, the formation has been misidentified west of its type area in Wise County. It may have been identified correctly east of its type area. —RLM

05548 **Miller, Robert Eugene.** Geochemical studies of bio-organic-montmorillonite in synthetic sea water and fresh water systems [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 761B, 1969.

Milliman, J. D. *See* Stetson, T. R. 05332

05320 **Milliman, John D.** Carbonate sedimentation on four southwestern Caribbean atolls and relation to "oolite problem" [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2040-2041, 1969.

05412 **Milton, Charles; Mrose, Mary E.; Hearn, B. Carter, Jr.** Correction — Nepheline syenite at Brookville, New Jersey [1964]: Am. Jour. Sci., v. 267, no. 9, p. 1112-1113, 1969.

In 1964 , Milton (ibid., v. 262, p. 1119-1123), denied the existence of nepheline syenite at the location but recent work has shown it to be indeed present. The petrographic descriptions of the nepheline are given, and the characteristics of the mineral and the host syenite are given as guides for future studies. — HRC

Mitchell, James K. *See* Singh, Awtar. 05407

05431 **Mitchell, James K.; Singh, Awtar; Campanella, Richard G.** Bonding, effective stresses, and strength of soils: Am. Soc. Civil Engineers Proc., v. 95, paper 6786, Jour. Soil Mechanics and Found. Div., no. SM5, p. 1219-1246, illus., tables, 1969.

The theory of rate processes has been used to deduce values of interparticle bond energies and number of interparticle bonds in different soils from creep tests. Measured values of activation energy for creep are of the order of 30 to 45 kcal per mole. Effective consolidation pressure is directly proportional to number of interparticle bonds per sq unit of cross section. A single linear relationship holds between them and compressive strength which applies equally to wet and dried remolded illite, undisturbed normal and over consolidated San Francisco Bay mud, and dry sand. This supports the hypothesis that interparticle contact is the only significant region between soil grains where effective normal and shear stresses can be transmitted, these contacts are effectively solid-to-solid, a single one may contain many interparticle bonds, and the number of bonds per contact depends on compressive force transmitted there. — *from* ASCE abstract

Mitchell, James K. *See* Houston, William N. 05436

05508 **Mitchell, James K.; Houston, William N.** Causes of clay sensitivity: Am. Soc. Civil Engineers Proc., v. 95, paper 6568, Jour. Soil Mechanics and Found. Div., no. SM3, p. 845-871, illus., tables, 1969.

Factors were examined leading to differences between undisturbed and remolded clay fabrics and interparticle forces. A consideration of available knowledge would

suggest 8 different mechanisms which might lead to development of sensitivity. Only two — leaching of salt water from marine clays and introduction of dispersing chemicals, either through decomposition of material already present or by leaching into clay — would appear adequate to account for extra quick clays. Ion exchange effects, particle arrangements induced by physical factors only, and cementation may lead to slightly quick clays, but the more usual contribution is probably much smaller. The remainder — silt skeleton-bond clay structure, thixotropic hardening, and weathering — appear to account for only medium sensitivities. The total sensitivity of a given undisturbed clay may be made up of contributions from several causes. — *from* ASCE abstract

05669 **Mitra, R. P.; Kapoor, B. S.** Acid character of montmorillonite — Titration curves in water and some non-aqueous solvents: Soil Sci., v. 108, no. 1, p. 11-23, illus., tables, 1969.

The pH-titration curves of freshly prepared montmorillonite showed that H^+ ions, Al^{3+} ions, and a weak acid reacted with the base. pH titration of a neutral salt extract of the acid clay showed that the H^+ and Al^{3+} ions could be completely exchanged for the cations in the salt. The weak acid could not be extracted. Aging the montmorillonite in water produced basic Al ions which were exchangeable. — JWH

05547 **Moench, Allen Forbes.** An evaluation of heat transfer coefficients in moist porous media [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 731B, 1969.

05132 **Monahan, Edward James.** Pore pressure development in a bearing capacity test on an overconsolidated clay model [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1117B, 1969.

05462 **Monroe, Watson H.** Evidence of subterranean sheet solution under weathered detrital cover in Puerto Rico, *in* Problems of the karst denudation — Internat. Speleol. Cong., 5th, Stuttgart 1969, Supp.: Československ. Akad. Věd Geog. Ústav Brno Studia Geog. 5, p. 111-121, illus., 1969.

Pure limestone deposits in northern Puerto Rico are overlain by discontinuous sheets of sand and sandy clay, termed blanket sands. The limestone below the blanket sands has been dissolved by sheet solution, so that the sand has been lowered from a few meters to possibly more than 70 meters, leaving projecting hills and ridges of limestone known as mogotes and ramparts. Some of the sand was deposited along the shore during an interglacial stage of high sea level. Estimates based on the most general age data indicate that the rate of lowering of the sand by sheet solution of the underlying limestone has been between 3 and 30 centimeters per thousand years. — Author's abstract

05101 **Moore, Carlton B.; Gibson, Everett K., Jr.; Kell, Klaus.** Nitrogen abundances in enstatite chondrites: Earth and Planetary Sci. Letters, v. 6, no. 6, p. 457-460, table, 1969.

The total nitrogen in 12 enstatite chondrites was measured by inert carrier gas fusion extraction. All but two of the meteorites are observed falls. The nitrogen content of type I chondrites is higher than intermediate types and type II without sinoite. Sinoite-bearing chondrites are higher by a factor of 2 in nitrogen percent than type I. If type II is metamorphosed type I, the trend toward volatile depletion is reversed in nitrogen. It may be due in part to the oxygen fugacity differences during formation of types I and II, or nitrogen abundance patterns and major chemical differences between types I and II were established before or during agglomeration of the chondrules and later heating had no effect on the chemical composition. — HRC

05309 **Moore, Gerald K.; Brown, Donald L.** Stratigraphy of the Fort Pillow test well, Lauderdale County, Tennessee: Tennessee Div. Geology Rept. Inv. 26, 1 sheet, illus., tables, 1969.

This report summarizes stratigraphic interpretations and ground-water and chemical-quality-of-water data obtained from a 3,183-ft test hole drilled in 1965 at Fort Pillow. The Wilcox Group in the subsurface is subdivided here into: Old Breastworks Formation, Fort Pillow Sand, and Flour Island Formation. Memphis Sand is named and defined as the basal formation in the Claiborne Group; the presence of the Cook Mtn. and Cockfield Formations of the Claiborne is indicated. From floral evidence, the top of the Claiborne is at least 240 feet higher in the section than has been thought previously; uppermost Eocene formation is the Jackson(?) Formation. Owing to uncertainties, it is proposed that all Eocene strata above the Cook Mtn. and below the loess and underlying gravels be tentatively referred to as "Cockfield through Jackson (?) undivided." —*from* Authors' abstract

05210 **Moore, James G.** Geology and mineral deposits of Lyon, Douglas, and Ormsby Counties, Nevada, *with a section on* Industrial minerals *by* N. L. Archbold: Nevada Bur. Mines Bull. 75, 44 p., illus., tables, geol. maps, 1969.

This area is within borders of the Cretaceous Sierra Nevada granitic batholith, in which Triassic and Jurassic roof-pendants are metamorphosed clastic and volcanic rocks; overlying all is an extensive sequence of mainly Pliocene or Pleistocene volcanics and interbedded sedimentary rocks. The tricounty area is also within the Basin and Range province, the main north-trending ranges tilted west and bounded on the east by east-dipping normal faults; two east-trending ranges, uplifted more by warping than faulting, are probably younger. Main rivers are consequent to the structure. Since Nevada's first discovery of gold in 1850 in Lyon County, mineral commodities valued at over 300 million dollars have been produced in the three counties—chiefly silver and gold from the Silver City district, and copper from near Yerington where a new iron deposit and cement plant look promising. —GDC

05233 **Moore, P. B.** Crystal chemistry of the basic iron phosphates [abs.]: Canadian Mineralogist, v. 10, pt. 1, p. 140-141, 1969.

05063 **Moore, Raymond D.** Addendum [to Pt. 1]—Occurrence of *Cibolocrinus seminolensis* Strimple, n.sp., in southern Kansas, *in* Fossil crinoid studies: Kansas Univ. Paleont. Contr.—Paper 42, p. 6-7, illus., 1969.

In an unpublished report by Moore and R. M. Jeffords, a new species of *Cibolocrinus* (*seminolensis*) was identified from lower Coffeyville beds at Coffeyville, Montgomery County, southern Kansas. This occurrence and that reported by Strimple (ibid., p. 1-5) are very little above the base of Missourian strata which form the bottom part of deposits classed as Upper Pennsylvanian; they are identical or near-identical in age and thus support the contention that crinoids are excellent fossils for precise stratigraphic correlation and age determinations. —MCM

05069 **Moore, Willard S.** Oceanic concentrations of ^{228}radium: Earth and Planetary Sci. Letters, v. 6, no. 6, p. 437-446, illus., tables, 1969.

Nearshore waters are very high in unsupported Ra-228; the concentrations decrease away from the land. The Ra-228 content of the surface waters bears a close correlation with the proximity to land. Samples from the Atlantic are higher than those from the Pacific Ocean. Apparently the source of the Ra-228 in surface waters is diffusion from Th-232-bearing sediments in contact with these waters. Water from <100 m from the sea floor shows that Ra-228 is diffusing from deep-sea sediments as it is from near-shore sediments. Deep Pacific samples are generally lower than deep Atlantic samples. Intermediate water samples have less Ra-228 than either surface or bottom samples from the same area. Because the vertical mixing rate of the ocean is much greater than the mean life of Ra-228, little Ra-228 can penetrate into the intermediate ocean. —*from* Author's abstract

Morales, José C. *See* Bornemisza, Elemer. 05595

Moran, S. R. *See* Totten, S. M. 05500

Morgan, Ida M. *See* McIntosh, Willard L. 05384

05473 **Morgan, J. W.** Uranium and thorium in tektites: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 53-63, illus., tables, 1969.

Neutron activation analyses for uranium and thorium are reported for two australites, a javaite, a bediasite and a moldavite. A critical survey is made of published uranium and thorium abundances in tektites, and superior analyses selected. Uranium and thorium abundances in the tektite groups are compared with terrestrial sedimentary and acid igneous rocks. Granophyres match tektites most closely in the abundance of these two elements, but cannot be considered probable parent material for a terrestrial tektite origin because of their limited distribution. An extraterrestrial origin is also considered and a relationship in uranium and thorium abundance is observed between some achondrites and the tektites. — Author's abstract

05487 **Morgan, J. W.; Rebagay, T. V.; Showalter, D. L.; Nadkarni, R. A.; Gillum, S. E.; McKown, D. M.; Ehmann, W. D.** Allende meteorite — Some major and trace element abundances by neutron activation analysis: Nature, v. 224, no. 5221, p. 789-791, tables, 1969.

Sufficient material is now available (estimates of a fall of more than one ton have been made) that the Allende meteorite might serve as a source of "standard meteorite" powder for interlaboratory comparisons. In this hope, homogenized powders from three individual stones of the Allende fall have been analyzed for 14 elements covering a wide range of geochemical affinities — Si, O, Ni, Na, Co, Ir, Zr, Hf, An, Pt, Fe, Cr, Sc, and W. The similarity to Mokoia extends even to the trace elements. — DBV

05661 **Morrow, Norman R.; Graves, James R.** On the properties of equal sphere packings and their use as ideal soils: Soil Sci., v. 108, no. 2, p. 102-107, illus., 1969.

A plot of porosity versus the average acute face angle of a unit cell defines an attainable region with all boundary points corresponding to unique packing structures. In addition to providing a classification for all possible ideal soils formed from regular close-packed arrangements, the plot provides a useful aid in demonstrating smooth translations from one well-known packing structure to another. — JWH

05390 **Morton, D. M.; Streitz, R.** Reconnaissance map of major landslides, San Gabriel Mountains, California: California Div. Mines and Geology Map Sheet 15, scale 1 in. to 1 mi., 1969.

05016 **Mostafa, Abd-Elmonem Sayed-Ahmad.** Movement of phosphorus in soils as influenced by chelates and soil types [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 937B-938B, 1969.

05652 **Mount, Robert L.** Harnessing the heat from inside the earth to produce electricity: Sci. Forum, v. 2, no. 2, p. 20-22, illus., 1969.

Geothermal steam wells in western United States might generate 100 million kilowatts of electricity; a modest quantity may also be available in western Canada. The eastern flank of the East Pacific Rise, along which much more heat is dissipated than from areas of normal crustal thickness, underlies major fault zones of California; west of the Rocky Mountains, isolated hot spots occur where superheated magmas lie close to the surface, in conjunction with faults and ground water, as in Yellowstone Park. Fumaroles have long been well developed in Italy, New Zealand and Iceland. Hot springs may be used for heating or as a source of minerals, but power generation is limited to sites of dry steam which requires 1000° magmas, porous rock saturated with ground water, and a cap rock. Conditions are met at The Geysers, Calif., where in 1921 geothermal steam first generated power in the United States; it was commercially developed by 1960. — GDC

Mountjoy, W. T. *See* Hemley, J. J. 05294

Mrose, Mary E. *See* Milton, Charles. 05412

05546 **Muir, Clifford Donald.** Stability of slopes with seepage [abs.]: Dissert. Abs. Internat. Sec. B, Sci. and Eng., v. 30, no. 2, p. 662B, 1969.

05498 **Murray, John W.** Recent foraminifers from the Atlantic continental shelf of the United States: Micropaleontology, v. 15, no. 4, p. 401-419, illus., tables, 1969.

Composition of living and dead populations of foraminifers of Vineyard Sound, Mass., and the shelf off Long Island, N.Y., and off Cape Hatteras, N.C. are compared. Vineyard Sound is a region of fast tidal currents, and most benthic foraminifers cling to the substrate; density and biomass are generally low. The shelf off Long Island is a lower energy cold-water environment, living foraminfers show affinities to Arctic assemblages, diversity is low, and biomass is moderate. The shelf off Hatteras has a large horizontal temperature gradient with cooler Virginia coastal water in the north and warmer Carolinian coastal water to the south. Foraminifers show effects of this physical change both in species composition and in variable diversity, standing crop, and biomass values. In each case living populations differ markedly from the dead. — *from* Author's abstract

05023 **Murray, R. C.** Hydrology of south Bonaire, N. A.—A rock selective dolomitization model: Jour. Sed. Petrology, v. 39, no. 3, p. 1007-1013, illus., 1969.

The flow of fresh sea water onto the land takes place through permeability conduits in the underlying rock. Reflux of some heavy brine is probably continuously taking place because of gravitational instability. A major annual reflux event is controlled by the total pressure of the brine exerted at the level of an impermeable clay layer within the Recent sediments, being greater than the pressure exerted by the sea water at equivalent level. This annual return flow of brine moves through some of the same permeability conduits that supply fresh sea water through most of the year. Dolomite formed by such a hydrology should be confined to the permeability paths underneath an evaporitic sediment in older rocks. This pattern of rock-selective or permeability-controlled dolomitization may be common in ancient rocks. —*from* Author's abstract

Mutschler, Felix E. *See* Larson, Edwin E. 05477

05463 **Muxart, R.; Stchouzkoy, T.; Franck, J.** Contribution a l'étude de la dissolution des calcaires par les eaux de ruissellement et les eaux stagnantes, *in* Problems of the karst denudation—Internat. Speleol. Cong., 5th, Stuttgart 1969, Supp.: Československ. Akad. Věd Geog. Ústav Brno Studia Geog. 5, p. 21-42, tables, 1969.

Total static action of running surface water on denuded limestone (covered by moss or in contact with soil), also of stagnant water (in peat bogs, ponds and sink-holes), has been measured under different climatic conditions. Results have been compared to theoretical values determined from curves of equilibrium in the system $CaCO_3$-CO_2-H_2O. In spite of the very insufficient number of measurements, we attempt to define the importance of karst erosion by surface waters as a function of diverse climate types [tropical humid — Puerto Rico and Jamaica; oceanic — Ireland; arctic — Lapland, Norway and Sweden; and temperate — France]. Emphasized are the difficulties met in the study of natural waters and the dangers of interpretation of the experimental data by theoretical considerations established for synthetically ideal water. — Authors' abstract, GDC

Nadkarni, R. A. *See* Morgan, J. W. 05487

Nakagawa, H. M. *See* Ward, F. N. 05310

Nason, Robert. *See* Tocher, Don. 05189

05619 **Nassichuk, W. W.** Permian ammonoids from the Belloy Formation, northeastern British Columbia [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 113-122, illus., 1969.

Three species of Permian ammonoids from the Belloy Formation are described: *Medlicottia chozaensis* Plummer and Scott, *Daraelites* cf. *D. elegans* Tchernow and *Daubichites* sp. The ammonoids indicate a Lower Permian, Artinskian (Leonardian) age. — Author's abstract

05620 **Nassichuk, W. W.** A Late Pennsylvanian ammonoid from Ellesmere Island, Canadian Arctic Archipelago [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 123-127, illus., 1969.

Parashumardites sp. is the only late Pennsylvanian ammonoid known from Canada. It was discovered in the Hare Fiord Formation at Hare Fiord, northern Ellesmere Island and provides data for correlation with Missourian strata in the United States and Zhigulevian strata in the Soviet Union. — Author's abstract

05035 **Neal, William J.** Diagenesis and dolomitization of a limestone (Pennsylvanian of Missouri) as revealed by staining: Jour. Sed. Petrology, v. 39, no. 3, p. 1040-1045, illus., table, 1969.

Calcite rim-cement in the Blackjack Creek Formation differs from the remaining pore-fill calcite chemically and morphologically. Staining with alizarian red-S and K ferricyanide shows that nonferroan calcite characterizes the dogtooth rim-cement whereas ferroan calcite characterizes the dominant mosaic cement. This difference records contrasting cementing environments, suggesting that the nonferroan cement is the product of conversion from aragonite that precipitated in the marine environment. The ferroan second-generation calcite was precipitated as such from circulating ground water in primary pores lined with the earlier calcite and in pores from solution of aragonitic bioclasts. Relative susceptibility to dolomitization was lime-mud matrix>ferroan-calcite spar>nonferroan calcite sparry cement>nonferroan calcite bioclasts. —*from* Author's abstract

05200 **Necioglu, Altan.** S-wave spectral properties in relation to crustal structures [abs.]: Earthquake Notes, v. 40, no. 2, p. 6, 1969.

05588 **Nelson, Gareth J.** Gill arches and the phylogeny of fishes, with notes on the classification of vertebrates: Am. Mus. Nat. History Bull., v. 141, art. 4, p. 475-552, illus., table, 1969.

The primitive condition for gnathostomes included numerous dermal elements. During evolution, these were organized into special structures of several types through fusion of various components. Advanced-type gill-arch dentition characterizes most of the major groups of fishes, and these types, combined with the gill-arch endoskeleton and muscles provide the basis for phylogenetic discussions of all major Recent fish groups. Conclusions are in essential agreement with other workers. The sister-group model of Hennig for classification appears to hold, and a higher classification of fishes is proposed. The classification includes the Recent tetrapods, the connection being at the rhipidistean fishes. The superclass Gnathostomata is proposed in which the major groups are arranged not arbitrarily but according to their probable phyletic relationships. —*from* Author's summary

Nettleton, W. D. *See* Flach, K. W. 05647

Newkirk, John B. *See* Barrett, Charles S. 05268

05203 **Newton, Carl A.; Alexander, Shelton S.** Rayleigh ellipticities and inferred structures [abs.]: Earthquake Notes, v. 40, no. 2, p. 8, 1969.

05053 **Newton, Robert C.** Petrology at high pressure and temperature: Nature, v. 224, no. 5217, p. 314-317, illus., 1969.

High pressure and high temperature work with rocks and minerals in various laboratories in various countries is beginning to explain some fundamental geophysical observations and to provide solutions to important problems of the Earth's interior. A recent comprehensive study of relationships between depth and density of the upper mantle, based on seismic data, has renewed interest in the phase-change hypothesis of the M-discontinuity. Large portions of the uppermost mantle must have a greater density than thought probable, thus eclogite may be more plausible than peridotite for its composition; the peridotite which must serve as a source of basaltic or eclogitic liquid may begin deeper than thought. Experimental petrology at very high

pressure has produced evidence which gives considerable insight into the transitions at 400 km and below 600 km, revealed by seismology. —DBV

05539 **Nichols, Maynard; Norton, Warren.** Foraminiferal populations in a coastal plain estuary: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 6, no. 3, p. 197-213, illus., 1969.

Benthic Foraminifera in the James River estuary, Chesapeake Bay region, are in 17 species, of which two make up 90 percent of the fauna. An arenaceous *Ammobaculites* fauna inhabits the upper estuary and a calcareous *Elphidium* fauna inhabits the lower estuary where bottom salinity exceeds 14 percent in spring and summer. The faunas meet at a sharp boundary. The distributions are related to salinity and shift with time and flow. Large populations of few species occur in the middle estuary, and live-total ratios reflect foraminiferal production and not sedimentation. The James estuary fauna is similar to other nearshore faunas from elsewhere in the world that are distinguished by sharp boundaries, scattered fossil and marsh dwelling species, and distinct distributional patterns. — *from* Authors' summary

Nielsen, Richard L. *See* Sheppard, Simon M. F. 05257

05374 **Nishimura, Susumu.** Radium and uranium contents of standard rocks: Chem. Geology, v. 5, no. 2, p. 139-141, tables, 1969.

The six U.S. Geological [Survey] standard rocks together with JG-1, issued by the Geological Survey of Japan, have been analyzed with a neutron activation technique and a radon method, and the results for each rock are tabulated. — Author's abstract

05668 **Nishita, H.; Hamilton, M.** Heating effects on the thermoluminescence of gamma irradiated soils: Soil Sci., v. 108, no. 1, p. 1-10, illus., 1969.

The effects of pre-irradiation and post-irradiation heating on the thermoluminescence of several soils exposed to Co^{60} gamma rays were studied. Some attempts were made to determine the effect of pre-irradiation heating on bentonite, illite, and kaolinite, and on $CaSO_4$, $CaCO_3$, CaO, MgO, $MgCO_3$, Na_2CO_3, and K_2CO_3. — JWH

Noble, D. C. *See* Rosholt, J. N. 05104

05492 **Nolan, J.** Physical properties of synthetic and natural pyroxenes in the system diopside-hedenbergite-acmite: Mineralog. Mag., v. 37, no. 286, p. 216-229, illus., tables, 1969.

Unit cell dimensions and refractive indices have been determined for synthetic pyroxenes in the system $CaMgSi_2O_6$-$CaFeSi_2O_6$-$NaFeSi_2O_6$ at 700°C and a pressure of 2 kb. Data presented confirm the many postulates that a complete solid solution series does exist in the subsolidus region of the "ternary" system. Unit cell dimensions show an almost linear change with composition between end members. The determined cell parameters for a series of analyzed natural alkali pyroxenes have been compared with the data for synthetic pyroxenes and close agreement was found between both sets. Variation of unit cell dimensions and refractive indices has been examined in relation to possible ionic substitutions taking place in the pyroxenes. — *from* Author's summary

05616 **Norford, B. S.** The Early Canadian (Tremadocian) trilobites *Clelandia* and *Jujuyaspis* from the southern Rocky Mountains of Canada [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 1-15, illus., 1969.

Five species are described from the lower part of the Survey Peak Formation of southwest Alberta and adjacent British Columbia. *Clelandia texana* Winston and Nicholls, *C. albertensis* n. sp., and *Jujuyaspis borealis* Kobayashi are from the *Symphysurina-Euloma* Zone (A); *Clelandia utahensis* Ross and *C. wilsoni* n. sp. are from the *Bellefontia-Xenostegium* Zone (B). These basal zones of the Canadian in western North America are of Tremadocian age, and are either Lower Ordovician or Upper

Cambrian. The bases of these zones are defined by the first appearances of *Symphysurina* and *Bellefontia*. *Clelandia* and *Jujuyaspis* seem to be restricted to rocks of Tremadocian age. The type species of *Clelandia* is redescribed. — *from* Author's abstract

05152 **North, William Gordon.** The stratigraphy of the formations at and beneath the Middle-Upper Devonian boundary in southern Illinois [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1203B, 1969.

05245 **Northrop, Stuart A.** History of the New Mexico Geological Society, 1947-1968: New Mexico Geol. Soc. Spec. Pub. 2, 78 p., tables, 1969.

The first meeting of the New Mexico Geological Society, held in 1947, was instigated by V. C. Kelley, Caswell Silver, and Gordon H. Wood, Jr. This compendium includes accounts of early meetings, constitution, officers, membership, annual meetings, field conferences and guidebooks of various organizations, New Mexico Geological Society field conferences (1950-1968), and miscellaneous activities. — MCM

Norton, Warren. *See* Nichols, Maynard. 05539

Nowroozi, A. A. *See* Savino, J. 05170

Nuttli, Otto. *See* Stauder, William. 05175

05192 **Nuttli, Otto W.; Bolt, Bruce A.** Undulations of the mantle low-velocity channel as an explanation of azimuth-dependent P wave residuals [abs.]: Earthquake Notes, v. 40, no. 2, p. 10, 1969.

05281 **O'Connor, G. A.; Kemper, W. D.** Quasi-crystals in Na-La systems: Soil Sci. Soc. America Proc., v. 33, no. 3, p. 464-469, illus., table, 1969.

Drying of Ca-clays pushes platelets into closely oriented quasi-crystals which maintain cohesiveness when rewetted. Exchange capacity measurements on dried Ca systems were 20 percent lower in bentonites and 40 percent lower in soils than the actual exchange capacities of these materials. Dried Ca-bentonites maintain a 10 percent higher level of adsorbed Ca than nondried. If salt concentration is lowered to 0.045 *N*, swelling pressures between platelets force quasi-crystals to disintegrate. Adsorption energies of calcium ions on internal surfaces of quasi-crystals are higher than on external. Hysteresis loops in swelling pressure curves recorded at increasing and decreasing Na-saturation are indicative of quasi-crystals; those for dried Ca-clays exhibit hysteresis loops which disappear as crystals are destroyed by repeated Na-saturation. Nondried Ca-clays exhibit no loops when pressures are low. —*from* Authors' abstract

Ogiesby, Woodson R. *See* Ball, Mahlon M. 05345

05116 **Ohmoto, Hiroshi.** The Bluebell mine, British Columbia, Canada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1204B, 1969.

05516 **Olsen, Harold W.; Chen, Albert T. F.** Seismic response of horizontal soil layers — Discussion [of paper 6043 by I. M. Idriss and H. Bolton Seed, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM3, p. 927-930, illus., 1969.

One point not clearly illustrated in Paper 6043 (ibid., v. 94, no. SM4, 1968) is that the seismic response of a given site depends not only on geometries and material properties of the soil layers, and magnitude of seismic input base motions, but also on the input frequency characteristics which vary with different earthquakes and epicenter distance. Base input and surface accelerations versus time for the El Centro and 1957 San Francisco earthquakes, California, are compared here and expressed in terms of power spectral density estimates. Such techniques contribute to the practical usefulness of Idriss and Seed's analytical methods.—GDC

05558 **Oltz, Donald Frederick, Jr.** Numerical analyses of palynological data from Cretaceous and Early Tertiary sediments in east central Montana [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 525B, 1969.

05383 **Orkild, Paul P.; Sargent, K. A.; Snyder, R. P.** Geologic map of Pahute Mesa, Nevada Test Site and vicinity, Nye County, Nevada: U.S. Geol. Survey Misc. Geol. Inv. Map I-567, scale 1:48,000, section, separate text, 1969.

05471 **Ostic, R. G.; El-Badry, H. M.; Kohman, T. P.** Isotopic composition of meteoritic thallium: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 72-76, illus., tables, 1969.

Thallium contents have been determined as $2.5 \pm 0.5 \times 10^{-6}$ in Ivigtut, Greenland, galena; $7 \pm 2 \times 10^{-10}$ in Plainview chondrite; $1.5 \pm 0.3 \times 10^{-9}$ in Canyon Diablo troilite; and $2.5 \pm 0.5 \times 10^{-10}$ in Canyon Diablo metal. The Tl-205/Tl-203 ratio is identical within about 0.6 percent of that of terrestrial thallium reagent, thus yielding no indication of extinct natural radioactivity of Pb-205 (half life about 24 m.y.). Using published lead contents of the meteoritic materials, plot of Tl-205/Tl-203 vs. Pb-204/Tl-203 has been made of our results and those of Anders and Stevens. Only limiting slopes can be indicated for various groups of data. The uncertainties of these data and the indicated variability of the Tl/Pb ratio in meteoritic materials suggest that more precise and extensive measurements may reveal radiogenic Tl-205. — *from* Authors' abstract

05321 **Otvos, Ervin G.** Moreau-Caminada chenier complex, southeastern Louisiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2041-2042, 1969.

Owens, E. H. *See* McCann, S. B. 05059

05243 **Park, W. G.; Wood, S. O., Jr.; Carrales, M., Jr.** Heavy oil reservoirs in Arkansas: U.S. Bur. Mines Inf. Circ. 8428, 162 p., illus., tables, 1969.

Much of the difficult to recover viscous, or heavy oil, in Arkansas is in reservoirs having characteristics considered favorable for thermal type recovery. About 600 million bbl of heavy oil have been recovered from 150 reservoirs in 83 oil fields through 1966, but about 88 percent, 4.5 billion bbl remained in the ground. Discussion of individual fields includes data on thermal recovery projects already started. — ERL

05266 **Parsley, A. J.; Doveton, J. D. H.** The role of some statistical and mathematical methods in the interpretation of regional geochemical data [discussion of paper by Nichol, Garrett, and Webb, 1969]: Econ. Geology, v. 64, no. 7, p. 830, 1969.

Trend-surface fits of the magnitude of those presented can be produced by surfaces fitted to randomly generated data. The low fits suggest that the scale of operation of the geologic processes giving rise to the major components of variability are smaller than the area represented by each observation point. "Mathematical techniques should be used to make or prove a point rather than merely bring out some desired features." [Original paper, ibid., v. 64, p. 204-220, 1969.] — WSW

Parsons, Roger B. *See* Balster, Clifford A. 05042

Patterson, Colin. *See* Rosen, Donn Eric. 05657

05228 **Pearce, T. H.** The interpretation of natural chemical data in variation diagrams [abs.]: Canadian Mineralogist, v. 10, pt. 1, p. 143, 1969.

05649 **Pedro, C.; Jamagne, M.; Begon, J. C.** Mineral interactions and transformations in relation to pedogenesis during the Quaternary: Soil Sci., v. 107, no. 6, p. 462-469, tables, 1969.

With the present state of our knowledge, the author states that it is difficult to give accurate indications of the relations existing between the pedomineralogy and the geology of the Quaternary. However, studies of the Quaternary formations have contributed much to our knowledge of crystallochemical weathering of micaceous clays in humid temperate zones during pedogenesis. — JWH

05410 **Pennsylvania Geological Survey.** Limestone and dolomite distribution in Pennsylvania: [Harrisburg, Pa.] Pennsylvania Geol. Survey, scale about 1 in. to 20 mi., text [1969,].

Carbonate rocks in Pennsylvania affect man's activities in three main ways: as hazards, as mineral resources, and as ground water reservoirs. Solution cavities may become large enough to form tunnels, caves, caverns, and surface sink holes, thus requiring detailed planning studies prior to construction or development in limestone-dolomite areas. Limestones and dolomite are valuable mineral resources for roads and railroads, fluxstone for blast furnaces, concrete, cement, and agricultural lime. Areas underlain by limestone and dolomite may supply water needs of a community through proper development of subsurface water resources; the porous nature of the rocks may also permit influx of sewage and surface wastes, which necessitates planning for disposal. — MCM

Pepin, R. O. *See* Black, D. C. 05068

05219 **Peppers, R. A.; Damberger, H. H.** Palynology and petrography of a Middle Devonian coal in Illinois: Illinois Geol. Survey Circ. 445, 35 p., illus., tables, 1969.

Three drill cores of Wapsipinicon Limestone in McLean and northern DeWitt Counties have yielded layers of coal and coaly shale less than 1 to 2 inches thick, the only known occurrence of Devonian cal in the state. Spores constitute about 12 percent of the laminated coal and 3 percent of the nonlaminated; the rest of the coal consists of the maceral vitrinite; mineral matter includes pyrite, limestone, quartz, dolomite, calcite, and very fine grained claycy carbonates. Of 28 species and 13 genera of small spores, six species are new; 3 genera of marine plant microfossils were also identified. The spore assemblage does not resemble any previously described. The coal was deposited along the north flank of the Sangamon Arch in a nearshore environment; most of the spores were probably derived from small hydrophilous land plants. —VMJ

Perch-Nielsen, K. *See* Birkelund, T. 05627

Percy, G. R. *See* Sinclair, A. J. 05263

Perkins, R. W. *See* Cooper, J. A. 05285

Perkins, R. W. *See* Rancitelli, L. A. 05521

05322 **Petersen, W. A.** Uranium on horseback, or, South Texas revisited [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2042, 1969.

Peterson, M. N. A. *See* Bostrom, K. 05481

05300 **Petrascheck, W. E.** Ore metals from the crust or mantle: Econ. Geology, v. 64, no. 5, p. 576-578, 1969.

Except for the basaltophile elements like Fe, Ni, and Cu, a crustal source seems likely for most metals. This may be reconciled with evidence for a role of the mantle and magma from the mantle in the formation of mineral deposits if the concentrating element was the sulfur of the mantle magma. There is need for a regional delimitation of geochemical provinces to aid in distinguishing those of crustal from those of mantle derivation. —WSW

05220 **Pfeffer, Karl-Heinz.** Charakter der Verwitterungsresiduen im tropischen Kegelkarst und ihre Beziehung zum Formenschatz [with English summ.]: Geol. Rundschau, v. 58, no. 2, p. 408-426, illus., tables, 1969.

Weathering residues from the cockpit karst areas of Jamaica, southern Mexico, and Puerto Rico are very diverse. The soils, grain size distribution, clay minerals, and chemical composition of the residues vary over the cockpit karst area. When weathering residues accumulate in the bottom of cockpits they prevent further downward corrosion, and corrosive lateral widening takes place which may end in fu-

sion of cockpits and removal of most of the stacks between them. That such mature cockpit karst may be constant even well above the corrosion base level is demonstrated in parts of Jamaica and Puerto Rico. —DBV

05451 **Pfeffer, Karl-Heinz.** Kalkkrusten und Kegelkarst [with English abs.]: Erdkunde, v. 23, no. 3, p. 230-236, illus., 1969.

In SW Jamaica three variants of cockpit-karst phenomena were observed in one area: steep pillars completely formed in firm white limestone; steep pillars encrusted with external stalactites and travertine on bare rock interstices and overhangs; and hillocks and cockpits covered with weathering residues, including a limestone crust overlying decomposed limestone particles. Typical profiles were taken and samples of limestone crust and decomposed limestone particles were laboratory analyzed. Limestone crusts in humid tropical areas are described from the literature, theories of their origin discussed, and types of formation investigated. From comparisons with data of Panos and Stelcl (1968), it is concluded that special conditions operate in Cuba, since travertine and limestone crusts have no significant influence on Jamaican forms. — *from* Author's abstract

05109 **Phelan, Michael Joseph.** Crustal structure in the Central Mississippi Valley earthquake zone [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1211B, 1969.

Phillips, Clifford R. *See* Ramsey, William L. 05388

Pickering, S. M., Jr. *See* Smith, James W. 05414

05286 **Pierce, T. B.; Webster, R. K.; Hallett, R.; Mapper, D.** Developments in the use of small digital computers in activation analysis systems, *in* Modern trends in activation analysis, V. 2 — Internat. Conf., Gaithersburg, Md., 1968, Proc.: U.S. Natl. Bur. Standards Spec. Pub. 312, v. 2, p. 1116-1120, 1969.

The PDP 8-computer has been used as a gamma spectrometer and for processing data for neutron and charged particle activation; equipment is described briefly. The original intention was to use the computer for operation as a gamma-ray spectrometer to perform functions normally expected of a 'fixed-wire' multichannel analyzer with the additional capability of a program computer. The system has now been used for nondestructive analysis by reactor neutron activation of samples of steels, alloys, and geochemical materials. Data from the spectrometer are stored on magnetic tape and transferred into a central 360/65 computer through a second PDP 8; further programs are being written to extend the usefulness of this system. — VSN

05252 **Pierce, William G.; Nelson, Willis H.** Geologic map of the Wapiti quadrangle, Park County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ-778, scale 1:62,500, sections, 1969.

05323 **Pilkey, Orrin H.; Blackwelder, Blake W.; Doyle, Larry J.; Estes, Ernest L.** Environmental significance of physical attributes of calcareous sedimentary particles [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2042, 1969.

Pirson, J. E. *See* Pirson, S. J. 05045

05045 **Pirson, S. J.; Pirson, J. E.; Alsinbili, M. B.** Exploration by surface electrical measurement: Oil and Gas Jour., v. 67, no. 43, p. 108-111, illus., 1969.

A new way to look for oil and gas is based on the premise that fluid hydrocarbon accumulations modify the physico-chemical properties of their sedimentary environment because accumulation was achieved through the medium of migrating waters expelled from the source beds. Formation waters expelled from great depths have individual characteristics, particularly with respect to their ability to corrode or oxidize the rock through which they move. Rocks in a vertical column overlying an oil field are partially protected from such corrosion by diffused oil and gas. Near-surface electrical measurements of the corrosive intensity (Eh), the acid-alkaline intensity

(pH), and the electrical potential gradient (SP) when combined give the static corrosion (Eh) or redox potential which is significantly related to the possible presence of an oil and gas field below. Results of some field tests are given. —WBC

Piwinskii, A. J. *See* Martin, R. F. 05261

05459 **Plusquellec, Paul L.; Sandberg, Philip A.** Some genera of the ostracode subfamily Campylocytherinae: Micropaleontology, v. 15, no. 4, p. 427-480, illus., tables, 1969.

This subfamily is known from middle Miocene to Recent sediments of the Atlantic and Gulf Coast Provinces and the Caribbean region by species of three similar genera: *Campylocythere, Acuticythereis,* and *Proteoconcha* n.gen. Among these genera are two distinct types of normal pores arranged on valves in consistent and diagnostic patterns. Eight species, three new, are herein assigned to *Proteoconcha.* The other two genera at present consist of only their respective type species. — *from* Authors' abstract

Poche, D. *See* Hopkins, E. 05368

05608 **Pohopien, K. M.** Field manual — An introduction to the megascopic study and determination of minerals and rocks (3d edition): Dubuque, Iowa, Wm. C. Brown Co. Publishers, 126 p., illus., tables, 1969; originally published 1963.

The purpose of this third edition is to provide students with an easy-to-carry and use, relatively complete manual for the study of earth materials. Part 1, on minerals, contains sections on: how to identify minerals, minerals listed by certain characteristics, mineral tables, mineral index, mineral uses, and chemical elements. Part 2, on rocks, contains sections on introduction to rock identification charts, major igneous rocks, major sedimentary rocks, major metamorphic rocks, and a glossary. — MCM

Pollack, Henry N. *See* Pomeroy, Paul W. 05172

05123 **Pollard, David Dierker.** Deformation of host rocks during sill and laccolith formation [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1204B-1205B, 1969.

Polzer, Wilfred L. *See* Schmalz, Bruce L. 05630

05172 **Pomeroy, Paul W.; Pollack, Henry N.; Levy, Michael A.** Seismicity movies of the circum-Pacific belt, 1961-1968 [abs.]: Earthquake Notes, v. 40, no. 2, p. 13, 1969.

05659 **Ponnamperuma, F. N.; Loy, Teresita A.; Tianco, Estrella M.** Redox equilibria in flooded soils — [Pt.] 2, The manganese oxide systems: Soil Sci., v. 108, no. 1, p. 48-57, illus., tables, 1969.

The Eh, pH, $P_{carbon\ dioxide}$, and Mn^{++} activity values of the solutions of 16 flooded soils, sampled weekly for 15 weeks, support the hypothesis that the manganese oxides involved in redox equilibria in soils that undergo seasonal oxidation-reduction are complex nonstoichiometric oxides of variable composition. — JWH

Pope, Allan. *See* Harding, Samuel T. 05182

Potts, Mark J. *See* Condie, Kent C. 05212

05171 **Powell, James A.** A statistical study of earthquake occurrence [abs.]: Earthquake Notes, v. 40, no. 2, p. 12-13, 1969.

05024 **Power, P. E.** Clay mineralogy and paleoclimatic significance of some red regoliths and associated rocks in western Colorado: Jour. Sed. Petrology, v. 39, no. 3, p. 876-890, illus., tables, 1969.

[Studies are reported on pre-Pennsylvanian red paleosols and overlying Pennsylvanian rocks.] Molas regolith was formed on limestones in which the clay mineral is illite.

The regolith contains mainly kaolinite, subordinate illite and minor montmorillonite, mixed-layer illite-montmorillonite, chlorite, and chlorite-vermiculite. The Maroon regolith formed on limestones or orthoquartzites which contain illite. In half the regolith sampled, mixed-layer clays occur together with dominant kaolinite; illite with subordinate kaolinite occurs in the remainder. The Front Range regolith overlies granodiorite, metamorphic rocks, and limestones in which the dominant mineral is illite. This regolith contains illite and mixed-layer illite-montmorillonite with minor kaolinite on the crystalline rocks and is dominated by illite or illite and kaolinite in subequal proportions on the limestone. Regoliths probably formed in a subhumid climate. —*from* Author's abstract

05391 **Price, Vaneaton, Jr.** Notes on a fault in Abbeville County, South Carolina: South Carolina Div. Geology Geol. Notes, v. 13, no. 3, p. 81-82, illus., 1969.

In the course of reconnaissance mapping in Abbeville County, a zone of cataclastic rocks was recognized, extending 22 miles northeastward from the Savannah River floodplain southeast of Loundesville, S.C. Rocks of this fault zone, in places 2,000 feet wide, are similar to ultramylonites described by Conley and Drummond (1965) and include phyllonite schist which upon weathering yields muscovite scales as seen in the Brevard zone, mylonite finely laminated or streaky in appearance, and a resemblance to augen gneiss where the zone seems to cut granite. Foliations within the zone are vertical or nearly so, and strike parallel to the zone. Outside of it, strikes vary and dips are in the range of 25° — 50°. — GDC

Priest, Amel. *See* Strimple, Harrell L. 05061

05040 **Prokopovich, Nikola P.** Deposition of clastic sediments by clams: Jour. Sed. Petrology, v. 39, no. 3, p. 891-901, illus., tables, 1969.

Filter feeders constantly remove suspended organic and inorganic particles from water, combine them with organic binder, and deposit them as excreta. The "sticky" excreta (and shells) trap sand and other particles and contribute to sedimentation. In the 113-mile-long Delta-Mendota canal in California the sediments are 20-35 percent "fines" which are probably excreta, 35-50 percent sand, and 30 percent clamshells. Live *Corbicula fluminea* are particularly numerous, on the order of 1,000 per square foot of sediment. The pumping rate of these creatures is about 20 cc/hour. The number and density of clams decreases downstream as does the sedimentation rates in the pools. Apparently smaller pumping-deposition of suspended particles by clams in downstream reaches results in correspondingly lower sedimentation rates. —*from* Author's abstract

05324 **Puri, Harbans S.; Dickau, Bruce E.** Use of radial pores in taxonomy and paleoecology of Ostracoda [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2042, 1969.

05264 **Pyrih, Roman Z.; Bisque, Ramon E.** Determination of trace mercury in soil and rock media: Econ. Geology, v. 64, no. 7, p. 825-828, illus., tables, 1969.

"The procedure involves chelation of mercuric ions by dithizone and extraction of mercuric dithizonate into methyl iso-butyl ketone. The extracted mercury in the immiscible organic layer is measured by atomic absorption." In a 1-gram sample, 50 ppb of Hg can be detected; larger samples permit detection of fewer ppb. The technique is especially well suited for the analysis of soils and organic-rich materials. — WSW

Raats, P. A. C. *See* Scotter, D. R. 05665

05222 **Rader, Eugene K.** Geology of the Stokesville and Parnassus quadrangles, Virginia: Virginia Div. Mineral Resources Rept. Inv. 19, 30 p., illus., tables, geol. maps, 1969.

In north-central Augusta County bedrock is mostly sedimentary with a total stratigraphic thickness of about 17,000 feet and consists principally of Cambrian, Ordovician, and Devonian units. Igneous dikes, plugs and sills, generally of nepheline

syenite and teschenite composition, are poorly exposed and are less than 50 feet thick. Structural trends are northeasterly. Between the Pulaski-Staunton fault in the southeast and North Mountain fault, Cambrian and Ordovician formations are folded in the major overturned Long Glade syncline and several minor anticlines and synclines; Little North Mountain consists of overturned Silurian and Devonian rocks, with a parallel thrust fault on the northwest slope and the broad West Mountain syncline beyond. Mineral resources are limestone, dolomite, shale, iron ore, sand and gravel. —GDC

05490 **Ragan, Donal M.** Olivine recrystallization textures: Mineralog. Mag., v. 37, no. 286, p. 238-240, illus., 1969.

Mosaic olivine textures, with straight triple grain boundaries meeting at angles of 120°, are common in dunites. This is a well-known feature of annealed metals, and is the result of grain-boundary migration during recrystallization in which the system tends toward a state of minimum interfacial energies. Geometrically similar textures are present at the boundaries between such mosaic grains and strain-banded relict olivine grains. The unstrained mosaic grains make angular projections into the strained grains exactly at the junctions between the deformation bands. These are interpreted to be triple junctions with the two differently-oriented bands acting as separate grains, and thus also due to recrystallization. — Author's summary

05517 **Ramanujam, C. G. K.; Stewart, Wilson N.** A *Lepidocarpon* cone tip from the Pennsylvanian of Illinois: Palaeontographica, Abt. B, v. 127, nos. 1-6, p. 159-167, illus., 1969.

This is an investigation of a *Lepidocarpon* cone tip from the Pennsylvanian of Illinois. Because of the presence of many extremely immature sporophylls along with older ones in the specimen, it has been possible to trace the ontogenetic stages of both the sporangium and lateral laminae. In the light of new information made available here, the evolution of the sporangial protection in Lepidodendrales has been discussed. The cone fragment has been compared with other species of *Lepidocarpon*. — Authors' abstract

05388 **Ramsey, William L.; Burckley, Raymond A.; Phillips, Clifford R.; Watenpaugh, Frank M.** Modern Earth science: New York, Holt, Rinehart and Winston, 550 p., illus., tables, 1969.

The primary objective of the textbook is to develop within the mind of the reader a concept of the Earth as a complex body whose present form and past development can be understood as a result of the operation of basic processes. Most of the units in the book are systematically arranged. The units are: the Earth in the Universe; the planet Earth; forces that sculpture the Earth; the Earth's envelope of water; the record of Earth history; and the Earth's atmosphere. —*from* Authors' preface

Rancitelli, L. A. *See* Cooper, J. A. 05285

05521 **Rancitelli, L. A.; Perkins, R. W.; Cooper, J. A.; Kaye, J. H.; Wogman, N. A.** Radionuclide composition of the Allende meteorite from nondestructive gamma-ray spectrometric analysis: Science, v. 166, no. 3910, p. 1269-1272, table, 1969.

The concentrations of Be-7, Na-22, Al-26, K-40, Sc-46, V-48, Cr-51, Mn-54, Co-57, Co-60, and Th-232 (Tl-208) have been measured in the Allende meteorite by nondestructive gamma-ray spectrometry. The high Co-60 content of the meteorite is indicative of a preatmospheric body with a minimum effective radius of 50 cm and a weight of 1650 kg; the Al-26 activity indicates a minimum exposure age of 3 m.y. — Authors' abstract

05291 **Ratté, James C.; Wayland, Russell G.** Geology of the Hill City quadrangle, Pennington County, South Dakota — A preliminary report: U.S. Geol. Survey Bull., 1271-B, p. B1-B14, illus., tables, geol. map, 1969.

The Hill City quadrangle, in the central Black Hills, South Dakota, is underlain by Precambrian phyllites and schist, which are intruded by granite and attendant zoned and unzoned pegmatites on the northwest flank of the Harney Peak dome. Adjacent to the dome, the schists are metamorphosed to sillimanite grade. The rocks are deformed by faulting and by two major and one minor set of folds. Gold, spodumene, tin, mica, beryl, feldspar, and tungsten have been mined in the quadrangle. —Authors' abstract

05519 **Rawson, Jack; Schultz, Gerald K.** Base-flow studies, Leon and Lampasas Rivers, Texas — Quantity and quality, January 16-17, 1968: Texas Water Devel. Board Rept. 97, 9 p., illus., tables, 1969.

The purpose of this investigation was to determine the quantity of tributary inflow and amount of interchange of surface and ground water in main streams, to relate the nature and concentrations of dissolved constituents in the base flow to geology and to activities of man, and to evaluate the water for municipal supply, irrigation, and industrial use. Much of the drainage area of upper reaches of the rivers is underlain by Edwards Limestone, ground water from which contributes to gain in streamflow. Inflow from tributary Nolan Creek accounts for much of the increase in mineralization of the main stem of Leon River. Change in chemical character of water in Lampasas River from sodium chloride to calcium bicarbonate type results from inflow from Salado Creek. — GDC

05052 **Read, William F.** The Oshkosh Meteorite: Meteoritics, v. 4, no. 2, p. 137-140, illus., 1969.

In the fall of 1961, fragments of an olivine-bronzite chondrite were found about 2 miles NNW of Oshkosh, Wisconsin, the total weight being 144.8 g. This paper fixes the exact location and describes the circumstances of the find. —Author's abstract

05181 **Reasenberg, P.; DeFazio, T.; Aki, K.** An accelerometer system for long period seismic measurement in the epicentral region [abs.]: Earthquake Notes, v. 40, no. 2, p. 18, 1969.

Rebagay, T. V. *See* Morgan, J. W. 05487

05549 **Reeber, Robert Richard.** Low temperature thermal expansion of wurtzite-phases of IIB-VIB compounds [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 761B, 1969.

05089 **Reed, G. W.; Jovanovic, S.** Some halogen measurements on achondrites: Earth and Planetary Sci. Letters, v. 6, no. 4, p. 316-320, tables, 1969.

Data are presented on halogen concentrations in various classes of achondritic meteorites. The importance of the lability of the halogens to the interpretation of rare gas data is pointed out. —Authors' abstract

Reel, D. A. *See* Griffin, G. M. 05366

Reeves, R. G. *See* Silberling, N. J. 05581

05510 **Reid, W. P.** Mineral staining tests: Colorado School Mines Mineral Industries Bull., v. 12, no. 3, 20 p., illus., 1969.

Staining tests for rapid mineral identification are compiled with sufficient details, including preparation of reagent solutions, that they may be applied with precautions to ore samples, rocks, and mill products without reference to the literature. Published source of each procedure is cited. Tested minerals are listed alphabetically, specific ones also found under group headings. Most of the tests, except on polished sections, can be adapted for field use. Laboratory experience with a technique is advised, before use in the field. Staining tests help to classify rock types being mapped in remote areas, and complement established techniques. Stains form more commonly by reaction between mineral and applied reagent than by dye ab-

sorption. Results depend on purity and relationships of minerals and texture and structure of rocks. — GDC

05284 **Reinig, W. C.; Evans, A. G.** Californium-252 — A new neutron source for activation analysis, *in* Modern trends in activation analysis, V. 2 — Internat. Conf., Gaithersburg, Md., 1968, Proc.: U.S. Natl. Bur. Standards Spec. Pub. 312, v. 2, p. 953-957, illus., tables, 1969.

Californium-252 is a valuable new neutron source for activation analysis. The high neutron yield from minute sources and their transportability make Cf-252 practical for mineral exploration and geophysical studies in remote environments on land, undersea, or extraterrestrial. —*from* Authors' conclusions

05201 **Reiter, Leon.** An investigation into the time term method in refraction seismology [abs.]: Earthquake Notes, v. 40, no. 2, p. 6-7, 1969.

05244 **Rensberger, John M.** A new iniid cretacean from the Miocene of California: California Univ. Pubs. Geol. Sci., v. 82, 34 p., illus., tables, 1969.

A skull, mandible and some postcranial skeletal remains of a fossil porpoise of a previously undescribed form were recovered from a marine deposit near Sunol, Calif. This mammal is most closely related to the family Iniidae. Biostratigraphic relationships indicate that the fossil occurred in early or middle Miocene rocks of the Monterey Group. — KAF

05106 **Renton, J. J.; Heald, M. T.; Cecil, C. B.** Experimental investigation of pressure solution of quartz: Jour. Sed. Petrology, v. 39, no. 3, p. 1107-1117, illus., tables, 1969.

Under loads from 2,500 to 12,000 psi and temperatures from 270° to 550°C, pressure solution occurred in distilled water and in solutions of NaOH, Na_2CO_3, NaCl and natural brines. Pressure solution pits were observed on quartz crystals. Fine sand compacted much faster than coarse sand, and fine angular sand faster (2.3 times) than fine round sand. The appearance of the angular sand was little different from that of the round sand after comparable pressure solution. Simultaneous pressure solution and quartz growth produced stronger aggregates than those from cementation alone. Chert grains responded more rapidly to pressure solution than monocrystalline quartz. Chert did not completely recrystallize, but the result resembled a solid mass. Thus as a result of pressure solution, initial differences in texture and composition of natural sands may lead to striking differences in final porosity. —*from* Authors' abstract

Rex, R. W. *See* Syers, J. K. 05644

05246 **Rexroad, Carl B.** Conodonts from the Jacobs Chapel Bed (Mississippian) of the New Albany Shale in southern Indiana: Indiana Geol. Survey Bull. 41, 55 p., illus., table, 1969.

The Jacobs Chapel Bed of the New Albany Shale in southern Indiana yielded a diverse and abundant conodont fauna. Twenty genera are considered indigenous and are represented by 57 species, none of which is new. *Siphonodella* is the most abundant genus and *Polygnathus communis* the most abundant species. Precise correlation and zonation are not possible, but the Jacobs Chapel Bed is Kinderhookian in age and correlates approximately with the middle and upper parts of the Hannibal Shale of the Mississippi Valley. — *from* Author's abstract

05556 **Reynolds, Peter Herbert.** A lead isotope study of ores and adjacent rocks [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 717B, 1969.

05325 **Rezak, Richard; Bouma, Arnold H.; Jeffrey, Lela M.** Hydrocarbons cored from knolls in southwestern Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2043, 1969.

Rezak, Richard. *See* Chmelik, Frank B. 05354

05282 **Rhoades, J. D.; Ingvalson, R. D.; Stumpf, H. T.** Interlayer spacings of expanded clay minerals at various swelling pressures—An X-ray diffraction technique for direct determinations: Soil Sci. Soc. America Proc., v. 33, no. 3, p. 473-475, illus., 1969.

An X-ray diffraction technique for determining interlayer spacings of expanded clay minerals at various swelling pressures has been developed. A swollen clay sample that has been equilibrated with an electrolyte solution is placed in a holder containing a porous ceramic plate, collection well, and drain outlet. The holder with sample is placed in a diffractometer mounted environmental chamber and then X-rayed at various applied air pressures. Brief results are given to demonstrate the applicability of the technique. These results show that a very stable average diffraction spacing of 45A persisted during the drying of a previously swollen Na-saturated montmorillonite until the air pressure exceeded 7.6 bars. With contraction the average diffraction spacings decreased from 45A to 19A in a quantized fashion without the appearance of intermediate spacings. —Authors' abstract

Rhodes, J. R. *See* Berry, P. F. 05273

05326 **Richards, Horace G.** Review of recent studies on marine Pleistocene of Atlantic coastal plain — New Jersey to Georgia [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2043, 1969.

Riecken, F. F. *See* Wells, K. L. 05599

Rieger, Samuel. *See* Kallio, Arvo. 05280

Rieger, Samuel. *See* Allan, R. J. 05602

05578 **Roberts, R. J.** Eureka-Elko, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 11/1-11/10, illus., table, 1969.

This is a road log for a one-day field trip of 162 miles beginning in Eureka and ending in Elko, Nev. Six stops are made; none are described in great detail, although geological observations along the route are included. Paleozoic rocks in the Cordilleran geosyncline are visited at the stops, and some of the structures are discussed. The Bell mine, a small silver-lead deposit, is examined also. —HRC

05579 **Roberts, R. J.** Elko-Cortez-Battle Mountain, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 12/1-12/11, illus., 1969.

This is a road log for a one-day field trip of 207 miles. Eight stops are made, with considerable geological commentary enroute, although none of the stops are more than briefly described. The Paleozoic rocks in the ranges are visited and many of the structural features are discussed. The Carlin gold mine is visited also. — HRC

05580 **Roberts, R. J.** Battle Mountain to Winnemucca, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 13/1-13/11, illus., 1969.

This is a road log for a one-day field trip of 100 miles. Nine stops are made, visiting Paleozoic rocks and structures; each is described briefly. Most are in Battle Mountain where various mines are included also. The evidence for the Antler orogeny is examined. — HRC

Robertson, D. K. *See* Cumming, G. L. 05267

05049 **Robertson, P. B.** La Malbaie structure, Quebec—A Paleozoic meteorite impact site: Meteoritics, v. 4, no. 2, p. 89-112, illus., 1969.

The La Malbaie structure has a central peak surrounded by lower hills and a semicircular valley with a diameter of 35 km. Rocks within the crater comprise charnockitic

and granitic gneisses, anorthosite, and gabbro of Precambrian Grenville age, and Middle Ordovician limestone. Autochthonous breccias, mixed breccias, shatter-cones, and microscopic shock deformation in the central uplift rocks provide evidence to support the meteorite impact hypothesis. Detailed study of quartz planar deformation features reveals that shock zones are concentric about the central peak with the zone of strongest deformation in the center. In comparison with range of deformation in other terrestrial meteorite craters, the exposed rocks of the central uplift at La Malbaie are representative of weak to moderate shock zones. —GV

Robertson, W. A. *See* Roy, J. L. 05276

05327 **Robinson, E.** Coiling directions in planktonic Foraminifera from Coastal Group of Jamaica [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2043, 1969.

05559 **Rodrigue, Raymond Fredrick.** Attenuation of nitrate by sorption from solution onto montmorillonite clay [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 547B, 1969.

05328 **Roehl, Perry O.** Permeability anisotropy in microsucrosic dolomites [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2043, 1969.

05173 **Rogers, G. C.** An earthquake swarm in northern British Columbia [abs.]: Earthquake Notes, v. 40, no. 2, p. 13, 1969.

05329 **Rogers, James K.** Possible groundwater influence on habitat of oil in Gulf Coast [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2043-2044, 1969.

05017 **Rogers, James Samuel.** The hydraulic conductivity-water content relationship during non-steady flow in a vertical sand column [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 938B, 1969.

05330 **Rogers, M. A.; Koons, C. B.** Organic carbon δC^{13} values from Quaternary marine sequences in Gulf of Mexico — A reflection of paleotemperature changes [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2044, 1969.

05386 **Rogers, Thomas H.; McClure, Duane A.** University research projects on California geology, 1968-1969: California Div. Mines and Geology Mineral Inf. Service, v. 22, no. 11, p. 184-190, illus., table, 1969.

Responses to a questionnaire sent out to learn about research being carried on by graduate students and faculty in colleges and universities totalled 227 — 35 from out-of-state schools, and 192 from California schools. Results are presented in a tabulation and on an index map. — MCM

Rogowski, A. S. *See* Zaslavsky, Dan. 05601

Romig, P. R. *See* Major, M. W. 05186

Rona, E. *See* Bonatti, E. 05349

05093 **Rona, Peter A.** Linear "lower continental rise hills" off Cape Hatteras: Jour. Sed. Petrology, v. 39, no. 3, p. 1132-1141, illus., table, 1969.

A grid of bathymetric profiles, a continuous seismic reflection profile, and short (1.2m) gravity cores show linear waveforms with regular distribution and orientation with parameters as follows: trough-to-trough wave length between 3 and 12 km; trough-to-peak amplitude between 10 and 100 m; crestal lengths of tens of kilometers, trending NW-SE; asymmetric with steeper limb facing the SW. Cores show lutite and clay. Similarity of these hills to megaripples is evidence of relation to deposition controlled by the Western Boundary Undercurrent. The waveforms may extend down to reflection horizon A (Cretaceous-Eocene) and the similarity of the waveforms to megaripples that extend continuously from horizon A to the present ocean bottom in the Argentine basin implies that the North and South Atlantic have

been open and intercommunicating at least since the initiation of the waveforms. —*from* Author's abstract

05013 **Rooney, Lawrence F.; French, Robert R.** Allogenic quartz and the origin of penemosaic texture in evaporites of the Detroit River Formation (Middle Devonian) in northern Indiana—Reply to discussion by D. W. Holliday [1969]: Jour. Sed. Petrology, v. 39, no. 3, p. 1258, 1969.

The suggestions of Holliday (ibid., p. 1256-1258) as regards a sebka theory of origin for the structures in the evaporite deposits are considered sound, but the original interpretation (ibid., v. 38, p. 755-765, 1968) of an origin from wave action and density settling still is a possibility as the sebka theory does not necessarily apply to all such structures as these. —HRC

05400 **Rose, E. R.** Geology of titanium and titaniferous deposits of Canada [with French abs.]: Canada Geol. Survey Econ. Geology Rept. 25, 177 p., illus., tables, geol. maps, 1969.

The nature of occurrence of the deposits of Canada in general and in detail is described; their distribution, classification, origin, age, size, and grade outlined; and the close relationships between them and anorthositic rocks pointed out. Most deposits occur in both massive and disseminated form throughout large, composite, intrusive anorthositic bodies in eastern Canada. The main ore minerals occur most abundantly in gabbroic phases of anorthosites, and commonly show exsolution textures characteristic of deposits formed at magmatic temperatures, and may possess self-reversing magnetic mechanisms, and hard components of remanent magnetism. Advantages and limitations of magnetic surveys in locating titanium deposits are discussed. — *from* Author's abstract

05657 **Rosen, Donn Eric; Patterson, Colin.** The structure and relationships of the paracanthopterygian fishes: Am. Mus. Nat. History Bull., v. 141, art. 3, p. 357-474, illus., tables, 1969.

The aim of this work has been to discover whether the superorder Paracanthopterygii is a monophyletic group and, if so, to find its limits and relationships. The supposed members of this superorder are the Percopsiformes, Gadiformes, Batrachoidiformes, Lophiiformes, and Gobiescoformes. The paper contains illustrated anatomical accounts of the living and fossil members of these groups, and detailed descriptions of the fossil percopsiforms *Trichophanes* (Oligocene, Aphredoderidae), *Amphiplaga*, *Erismatopterus* (both Eocene, Percopsidae), and *Sphenocephalus* (Upper Cretaceous, Sphenocephalidae), and the possibly related *Asineops* (Eocene). — *from* Authors' summary

Rosenshein, J. S. *See* Hunn, J. D. 05082

05104 **Rosholt, J. N.; Noble, D. C.** Loss of uranium from crystallized silicic volcanic rocks: Earth and Planetary Sci. Letters, v. 6, no. 4, p. 268-270, table, 1969.

Dense primarily crystallized silicic groundmass material from two welded ash-flow units and one lava flow of Tertiary age from the western United States contain only 20 to 60 percent of the uranium present in nonhydrated glass from the rock units. These differences reflect loss of uranium from the crystallized specimens, probably as a result of groundwater leaching. It appears likely that the most crystallized silicic volcanic rocks have lost comparable amounts of uranium. —Authors' abstract

05621 **Ross, Charles A.** Upper Paleozoic Fusulinacea—*Eowaeringella* and *Wedekindellina* from Yukon Territory and giant *Parafusulina* from British Columbia [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 129-134, illus., 1969.

Two new species of fusulinids are described: *Eowaeringella richardsonensis* from Middle Pennsylvanian (Desmoinesian) strata of the northern Yukon and *Parafusulina macdamensis* from Upper Permian (lower Guadalupian) strata of northern British

Columbia. *Wedekindellina* cf. *W. cabezaensis* Ross and Sabins is documented from the Middle Pennsylvanian (Desmoinesian) of the northern Yukon. — Author's abstract

05435 **Ross, Grant A.; Seed, H. Bolton; Migliaccio, Ralph R.** Bridge foundation behavior in Alaska earthquake: Am. Soc. Civil Engineers Proc., v. 95, paper 6664, Jour. Soil Mechanics and Found. Div., no. SM4, p. 1007-1036, illus., tables, 1969.

The Alaska earthquake of March 1964 caused extensive damage to bridge foundations within 80 miles of the epicenter. Frozen zones may have had some stabilizing influence, but damage was most dependent on foundation-support conditions. Displacements, correlated for about 60 bridges on the Seward, Sterling and Copper River Highways, increased in severity in the following order: on bedrock at one end and embedded in soils for the remaining length; embedded in gravels and sands; in medium to dense sands and silts through saturated sands and silts; in saturated loose to medium-dense sands and silts. Similarity of characteristics in numerous cases of landslides resulting from liquefaction of deltaic deposits suggests that liquefaction of soils adjacent to the bridge foundations played a major role in their damage. — GDC

05124 **Ross, Theodore William.** Granitic pegmatites in Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1205B, 1969.

05606 **Rowe, R. Robinson.** Lake Michigan-Huron stage-frequency and trend: Am. Soc. Civil Engineers Proc., v. 95, paper 6716, Jour. Waterways and Harbors Div., no. WW3, p. 261-274, illus., tables, 1969.

Stage of Lake Michigan-Huron and its postglacial antecedents has ranged 400 feet and its early north shore has been uplifted by crustal deformation 270 feet above the present shore. Eustatic rise of sea level exceeded 200 feet in the same period. Relatively steady now, these processes continue at a measurable rate. Diversions and degradation of the outlet channel contribute to recession and reliction. Using a time series of pentad stages 1860-1967, the time-recession relation was deduced as a mesograde curve, from which annual departures showed normal distribution and were used to postulate frequency of extreme lake stages. — ASCE abstract

05276 **Roy, J. L.; Robertson, W. A.; Keeping, C.** Magnetic "field free" spaces for paleomagnetism, rock magnetism, and other studies [with French abs.]: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1312-1316, illus., 1969.

An array of five sets of 8-ft (244-cm) square coils for compensation of the Earth's magnetic field at five locations is described. A fluxgate system is used to keep the residual field within 2 gammas during magnetic storms and 1 gamma in other instances. Constant fields (1 Oe down to a few gammas), for experiments in small magnetic fields, can be produced at four locations independently. — Authors' abstract

05631 **Ruhe, Robert V.** Principles for dating pedogenic events in the Quaternary: Soil Sci., v. 107, no. 6, p. 398-402, illus., 1969.

Soils are a part of the landscape, and zero time of soil development begins with the formation of the land surface. Zero time of soil formation of any cycle may be determined by relative or absolute dating methods or both. The author illustrates these principles with examples of loess constructional surfaces, stepped geomorphic surfaces, and hillslopes. — JWH

05077 **Runnells, Donald D.** Diagenesis due to mixing of natural waters—A hypothesis: Nature, v. 224, no. 5217, p. 361-363, illus., 1969.

Elementary chemical considerations suggest that the process of mixing of natural waters may be an important geologic phenomenon which has not been generally recognized. Mixing of waters which contain the components of rock-forming minerals may result in either under- or supersaturation, with the potential for leaching or precipitation. The quantitative relationships involved are geologically significant. Study and verification in the field are now necessary. —DBV

05098 **Runnells, Donald D.** Diagenesis, chemical sediments, and the mixing of natural waters: Jour. Sed. Petrology, v. 39, no. 3, p. 1188-1201, illus., table, 1969.

Fourteen distinct categories of natural waters occur, with 91 possible combinations of mixing of pairs. Examples are known of the precipitation of hydroxides and carbonates as a result of the mixing of chemically dissimilar surface waters. Documented examples of subsurface mixing and diagenesis are few, but may be a common and significant geologic process. The solubility of rock-forming minerals is a nonlinear function of such independent variables as salinity, partial pressure of gases, temperature, and so on. The dissolution of calcium carbonate as a result of "Mischungskorrosion" can be viewed in the light of the nonlinearity of the solubility curve. Experimental data on the solubility of calcium carbonate and sulfate as a function of added salts indicate that mixing of solutions which differ only in their content of dissolved electrolytes may cause either precipitation or dissolution. —*from* Author's abstract

Russell, Ernest E. *See* Wilson, Charles W., Jr. 05259

Ryder, Paul D. *See* Whitesides, D. V. 05655

05125 **Ryder, Robert Thomas.** The Beaverhead Formation—A Late Cretaceous-Paleocene syntectonic deposit in southwestern Montana and east-central Idaho [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1205B, 1969.

05331 **Sackett, W. M.; Cook, G.** Uranium geochemistry of Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2044, table, 1969.

Saint Arnaud, R. J. *See* McKeague, J. A. 05645

Sandberg, Philip A. *See* Plusquellec, Paul L. 05459

05417 **Sanford, B. V.** Geology, Toronto-Windsor area, Ontario: Canada Geol. Survey Map 1263A, scale 1:250,000, section, 1969.

05112 **Sardi, Otto.** The yttria-stabilized isometric phase of zirconia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1270B-1271B, 1969.

Sargent, K. A. *See* Orkild, Paul P. 05383

05636 **Sarich, Vincent M.** Pinniped origins and the rate of evolution of carnivore albumins: Systematic Zoology, v. 18, no. 3, p. 286-295, illus., tables, 1969.

Data resulting from an immunological study of relationships among fissiped and pinniped albumins show that albumin evolution has occurred in regular fashion in these taxa. This finding allows the conclusion that the pinnipeds share much more recent common ancestry with the canoids than either group does with the feloids. It is pointed out that it now appears possible to develop an internally consistent quantitative phylogeny for a group of species through the immunological study of a single protein found in that group. — Author's abstract

05408 **Sartenaer, Paul.** Late Upper Devonian (Famennian) rhynchonellid brachiopods from western Canada [with French abs.]: Canada Geol. Survey Bull. 169, 269 p., illus., tables, 1969.

Forty-one species and subspecies of Famennian rhynchonellids (22 new) are described in detail; 38 of the species and subspecies (19 new) belong to nine genera: *Trifidorostellum*, *Rugaltarostrum*, *Gastrodetoechia*, *Megalopterorhynchus*, *Eoparaphorhynchus*, *Sinotectirostrum*, *Evanescirostrum*, *Basilicorhynchus*, *Ptychomaletoechia*; two new species are assigned provisionally to *Pugnax* and one to *Plectorhynchella*. External and internal characters are illustrated. Stratigraphic extension and geographic distribution of the described forms are indicated. A new zonal scheme is proposed for the Famennian of the Rocky Mountains and Northwest Territories. — *from* Author's abstract

Sasaki, A. *See* Chrismas, L. 05158

05239 **Sasaki, Akira; Krouse, H. Roy.** Sulfur isotopes and the Pine Point lead-zinc mineralization: Econ. Geology, v. 64, no. 7, p. 718-730, illus., tables, 1969.

The mean δ S-34 value of 118 samples of ore sulfides is +20.1 permil, similar to the +19-20 permil for anhydrites of the Elk Point evaporite basin to the south, and to the value for Devonian formation brines. Sulfur in syngenetic or diagenetic sulfides in the country rocks is normal biogenic sulfur (δ S-34 from +9 to -19 permil). The most probable source of the Pine Point sulfur appears to be Middle Devonian sea-water sulfate from connate brine or solutions from the evaporite basin. The mechanism of reduction to sulfide with little isotope fractionation is still a question. — WSW

05314 **Sasaki, Akira.** Sulphur isotope study of the Muskox intrusion, District of Mackenzie (86J/13, 0/3): Canada Geol. Survey Paper 68-46, 68 p., illus., tables, 1969.

Sulfur isotope ratios have been determined in more than 300 samples of sulfides collected from about 260 localities in the intrusion and adjoining rocks. Results are given in δ S-34 per mil values with respect to the Canyon Diablo troilite sulfur, assuming its S-32/S-34 ratio to be 22.220. All samples from the intrusion have isotopic compositions enriched in S-34 relative to the meteorite. In the outermost 200 feet of the marginal zone, isotopic data correlate with the country rock. From the composite data, it is concluded that the average isotopic composition in the magma was about + 5 at the time of emplacement, and was preserved in the rocks of the layered series and inner part of the marginal zone, but appears to be modified in the feeder dyke and outer marginal zone due to interactions between magma and country rock. — *from* Author's abstract

05509 **Saum, N. M.; Link, J. M.** Exploration for uranium, Pt. 1: Colorado School Mines Mineral Industries Bull., v. 12, no. 4, 23 p., illus., 1969.

Increasing demand for uranium to fuel nuclear reactors has renewed the search for new uranium deposits. A brief history of uranium production compares that in the United States with other Free World reserves. Nuclear and geochemical properties of uranium, with idealized solution front and cross section, and genetic concepts with examples of features in hydrothermal, sedimentary, metamorphic and other types of deposits, are discussed. A brief discussion of exploration methods includes geologic, geophysical, geochemical, remote sensing, and drilling approaches. Fundamentals in all exploration programs are: first, regional reconnaissance, to define parameters and determine potential environments; the follow-up, to rapidly reexamine and reduce in size the target areas defined; then exploration. Efforts of skilled personnel are advantageous. — GDC

05183 **Savage, J. C.** A possible explanation of the orientation of fault planes for deep-focus earthquakes [abs.]: Earthquake Notes, v. 40, no. 2, p. 19-20, 1969.

05170 **Savino, J.; Nowroozi, A. A.; Alsop, L. E.** Eigenvibrations of Earth observed after Japanese earthquake of May 1968 [abs.]: Earthquake Notes, v. 40, no. 2, p. 12, 1969.

Sawhney, B. L. *See* Hill, D. E. 05596

05295 **Sawkins, Frederick J.** Chemical brecciation, an unrecognized mechanism for breccia formation: Econ. Geology, v. 64, no. 6, p. 613-617, illus., 1969.

By analogy with the phenomenon known as cement-aggregate reaction or alkali reactivity, which causes expansion and cracking of concrete, it is proposed that crystallization of fine-grained silica or dolomite from solution causes expansive cracking of rocks (chert and possibly porphyry). This mechanism may explain the formation of breccias and crackle breccias in situations where external force is precluded, as in many lead-zinc deposits. — WSW

Scharon, L. H. *See* Ehrlick, M. 05396

05205 **Schlanger, Seymour O.; Johnson, Charles J.** Algal banks near La Paz, Baja California — Modern analogues of source areas of transported shallow-water fossils in pre-

Alpine flysch deposits: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 6, no. 2, p. 141-157, illus., table, 1969.

Living red calcareous algae and coral reefs contribute skeletal debris in the shallow water around La Paz and Isla Espiritu Santo. A deep water core, taken downslope from algal banks of the La Paz basin, displays graded bedding containing abundant shallow water carbonate skeletal debris. These are similar to flysch deposits of early Tertiary age in Switzerland. Both share the following characteristics: (1) a tropical marine climate; (2) in land areas, including island chains, of high relief close by deep marine basins and troughs, the topography in large part is controlled by fault block structures; (3) the deep basins and the land areas are separated by narrow, shallow fringing shelves; (4) upon these shelves algal banks and coral reefs grow, and (5) resedimentation occurs by tidal, storm, and turbidity currents. — *from* Authors' summary

05630 **Schmalz, Bruce L.; Polzer, Wilfred L.** Tritiated water distribution in unsaturated soil: Soil Sci., v. 108, no. 1, p. 43-47, illus., tables, 1969.

It is concluded that approximately 3.5 percent of the tritium, which occurred in southeastern Idaho during a 15-year period, remained in the top 200 cc of the soil profile while the rest was lost by evaporation or transpiration. The observed distribution agreed with the calculated model based on diffusivity and convective processes. — JWH

05550 **Schmitt, Leonard Joseph.** Uranium and copper mineralization in the Big Indian Wash-Lisbon Valley mining district, southeastern Utah [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 713B-714B, 1969.

Schneider, Eric D. *See* Johnson, G. Leonard. 05102

Schreiber, Edward. *See* Liebermann, Robert C. 05465

05036 **Schroeder, Johannes H.** Experimental dissolution of calcium, magnesium, and strontium from Recent biogenic carbonates—A model of diagenesis: Jour. Sed. Petrology, v. 39, no. 3, p. 1057-1073, illus., table, 1969.

Laboratory experiments show that fresh water and sea water dissolve aragonite and magnesium calcite prior to mineralogical changes. Ca, Mg, and Sr are incorporated into the aragonite and Mg-calcite in lattice positions, absorbed in lattice interstices, or as inclusions. This suggests presence of more than one mineral phase in the skeletal material studied. Ca, Mg, and Sr are dissolved in proportions different from those in the original solid, that is, incongruently. The sequence of preference is Mg >Ca>Sr, as a rule. Direction and degree of incongruency are determined by mineralogy (phases present), chemical composition, physiologic effects, and chemistry and volume of water effective in dissolution. Incongruent dissolution determines abundance of ions derived from solids and hence Mg and Sr are not useful for paleoenvironmental studies. —*from* Author's abstract

Schultz, Gerald K. *See* Rawson, Jack. 05519

Schwertmann, U. *See* Blume, H. P. 05283

05499 **Scott, Harold W.** Discoveries bearing on the nature of the conodont animal: Micropaleontology, v. 15, no. 4, p. 420-426, illus., 1969.

Blebs of asphalt and platelike structures containing conodont assemblages identified as *Lochriea* sp. occur in the Late Mississippian Heath Shale of Montana. Associated with the blebs is a reticulate "skin" pattern. The structures are interpreted as belonging to an animal the head of which was, at least in part, composed of cartilagenous material, and was covered, at least in part, by a reticulated skin. — Author's abstract

Scott, R. C. *See* Mallory, E. C., Jr. 05452

05665 **Scotter, D. R.; Raats, P. A. C.** Dispersion of water vapor in soil due to air turbulence: Soil Sci., v. 108, no. 3, p. 170-176, illus., table, 1969.

Vapor fluxes at least two to four times larger than the flux due to molecular diffusion alone are predicted for evaporation from a depth of 2 cm below the surface in randomly packed spheres 4 to 6 mm diameter. Dispersion in real soils with wind over the surface is expected to result in much larger relative fluxes. The relative vapor flux increases very rapidly with increasing particle size. — JWH

05179 **Seed, H. Bolton; Idriss, I. M.** An analysis of ground motions at Union Bay during the 1967 Seattle earthquake [abs.]: Earthquake Notes, v. 40, no. 2, p. 17, 1969.

05404 **Seed, H. Bolton; Lee, Kenneth L.; Idriss, I. M.** Analysis of Sheffield Dam failure: Am. Soc. Civil Engineers Proc., v. 95, paper 6906, Jour. Soil Mechanics and Found. Div., no. SM6, p. 1453-1490, illus., tables, 1969.

Photographs and descriptions of the 25-ft high earthfill dam after the 6.5 magnitude earthquake [Santa Barbara, Calif., June 29, 1925] indicated that failure occurred by sliding on a nearly horizontal plane near the base. Pseudostatic methods of analysis using soil strengths determined by static loading tests indicated a theoretical factor of safety between 1 and 1.2; however, the position of the most critical sliding surface did not correspond with observed mode of failure. The study suggests that failure was initiated by liquefaction of a soil zone below the center and at the base of the dam; as shaking continued the zone of liquified soil spread laterally until after 10-15 sec the base became so weakened that the dam was pushed downstream by the force of the reservoir water. — *from* ASCE abstract

05429 **Seed, H. Bolton.** Landslides during earthquakes due to soil liquefaction — Closure [errata to paper 6110, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM4, p. 1123, 1969.

In describing the landslides around Kenai Lake in paper 6110 (ibid., v. 94, SM5, p. 1055-1122, 1968), volumes shown in a table of data compiled by D. McCulloch, inadvertently omitted in its title, are per foot width of the slide area; total volumes of soil involved in the slides, actually in cubic yards, are given here for Lakeview, Lawing, Ship Creek, and Rocky Creek. Original sources for a number of figures used were omitted by the printer; these credits are listed, with regret for errors. — GDC

05430 **Seed, H. Bolton; Idriss, I. M.; Kiefer, Fred W.** Characteristics of rock motions during earthquakes: Am. Soc. Civil Engineers Proc., v. 95, paper 6783, Jour. Soil Mechanics and Found. Div., no. SM5, p. 1199-1218, illus., 1969.

Rock motions during earthquakes are characterized in terms of maximum amplitude of accelerations, predominant period, and duration of the motions. It is shown that these characteristics depend mainly on earthquake magnitude and distance to the site from the zone of energy release. Available data relating rock motion characteristics to earthquake magnitude and distance to causative fault are presented and used to establish a general procedure for assessing maximum acceleration, predominant period, duration of shaking and time history of accelerations during any given earthquake. As an example, rock motions at the El Centro [California] site in 1940 are estimated, using the procedure, and incorporated in analyses of the response of the site. The computed surface motions are shown to be in good agreement with those recorded during the 1940 El Centro earthquake. — *from* ASCE abstract

Seed, H. Bolton. *See* Thiers, Gerald R. 05433

Seed, H. Bolton. *See* Ross, Grant A. 05435

Seed, H. Bolton. *See* Lee, Kenneth L. 05502

Semikhatov, M. A. *See* Cloud, P. E., Jr. 05454

05505 **Semler, Charles Edward, Jr.** Studies in the ternary system barium oxide-corundum-silica — The system celsian-silica-corundum [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 761B-762B, 1969.

05598 **Shainberg, I.; Kaiserman, A.** Kinetics of the formation and breakdown of Ca-montmorillonite tactoids: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 547-551, illus., 1969.

The kinetics was followed by recording the changes in light transmission with time when calcium and sodium montmorillonite suspensions were mixed in a titrating vessel which was placed in the light path of a spectrophotometer. Tactoid formation was found to be instantaneous, whereas the breakdown of the tactoids took about 10 min. — Soil brief

05133 **Sharma, Bijon.** Interpretation of gravity data due to faults and dikes [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1168B, 1969.

05083 **Sharp, Jonathan H.** Blue-green algae and carbonates—*Schizothrix calcicola* and algal stromatolites from Bermuda: Limnology and Oceanography, v. 14, no. 4, p. 568-578, illus., tables, 1969.

Algal stromatolites (laminated sedimentary structures) have been studied in the process of formation in subtidal areas of Bermuda. The primary organism is the blue-green alga *Schizothrix calcicola*. Laboratory studies of unialgal culture from water samples show that this species can bind sediment particles. Distribution of Bermudan algal stromatolites is apparently controlled mainly by current speed and rate of sediment transport, and not by availability of *S. calcicola*, which exists planktonically and is widely distributed on various substrates. Reports from other parts of the world indicate that this species is of major, if not primary, importance in formation of stromatolites everywhere. *Oscillatoria submembranacea*, an abundant secondary species in Bermudan stromatolites, is apparently not essential in those in other parts of the world. — VMJ

Shearer, James. *See* Lyall, Anil. 05028

Shelton, John W. *See* Matalucci, Rudolph V. 05038

05257 **Sheppard, Simon M. F.; Nielsen, Richard L.; Taylor, Hugh P., Jr.** Oxygen and hydrogen isotope ratios of clay minerals from porphyry copper deposits: Econ. Geology, v. 64, no. 7, p. 755-777, illus., tables, 1969.

Ratios were measured in 57 samples from 12 porphyry copper and 7 other deposits. Except for kaolinites in strongly acid supergene solutions, post-Paleozoic clays do not exchange much with low-temperature ground water, and preserve their original ratios, yet they show a geographic correlation with variations in present-day meteoric water. In areas where D/H for local meteoric water is similar to "magmatic" water values, results are inconclusive. At several places where they differ, however, "the isotope data require that hypogene hydrothermal solutions contain an appreciable percentage of meteoric water." The proposed model involves influx of meteoric water into hot granite stocks. — WSW

05536 **Sherif, M. A.** Cyclic stress-strain characteristics of clay — Discussion [of paper 5871 by Gerald R. Thiers and H. Bolton Seed, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM3, p. 898, 1969.

Paper 5871 (ibid., v. 94, SM2, p. 555-569, 1968) sheds light on the dynamic behavior of sensitive San Francisco Bay mud clay, under one frequency level of preassigned cyclic-strain, and covers a wide range of topics. Most significant changes in material properties are indicated during the first 10 cycles; however, the conclusion is puzzling that "when samples are subjected to cyclic strains of constant amplitudes producing shearing strains of less than 1.5 percent, the undisturbed static strength of the soils is virtually unaffected by 200 cycles of straining". This point might be clarified by knowledge of where the strength on the static stress-strain dia-

grams was defined. For other frequencies, the experimental conclusions may be different. — GDC

05025 **Shideler, Gerald L.** Dispersal patterns of Pennsylvanian sandstones in the Michigan basin: Jour. Sed. Petrology, v. 39, no. 3, p. 1229-1237, illus., 1969.

During Morrowan time, the Michigan basin was characterized by sediment dispersal controlled mainly by pre-Pennsylvanian topography. Sand was localized in high-energy lowlands. The delta originated near Saginaw Bay and prograded across the basin in southerly and westerly directions. In succeeding Atokan and Desmoinesian time, a broad alluvial plain persisted which contained an aggrading stream system draining west or southwest. Sand was concentrated in point-bar deposits and finer clastics in interchannel flood plain areas. The alluvial plain was only occasionally inundated by marine incursions. The provenance was relatively constant, with the primary avenue of detrital influx being consistently from the northeast. Sandstone petrology indicates a multicycle origin, with probable derivation from older Paleozoic arenites. —*from* Author's abstract

05551 **Shieh, Yuch-Ning.** Oxygen, carbon, and hydrogen isotope studies of contact metamorphism [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 714B, 1969.

05099 **Shinn, Eugene A.; Lloyd, R. Michael; Ginsburg, R. N.** Anatomy of a modern carbonate tidal-flat, Andros Island, Bahamas: Jour. Sed. Petrology, v. 39, no. 3, p. 1202-1228, illus., table, 1969.

The carbonate tidal-flat complex of northwestern Andros consists of three geomorphic areas: adjacent marine belt, channeled belt, and marsh. The various sedimentary accumulations within these belts are controlled by tide levels. Three tidal zones occur: subtidal, of sediments deposited below low tide (adjacent marine, channels, ponds); intertidal zone, of sediments deposited between high and low tides (intertidal flats); and supratidal zone, of sediments deposited above normal high tide but within the range of spring and storm tides (beach ridges, levees, marsh). Early diagenesis (oxidation, reduction, dolomite formation, and carbonate cementation) is also controlled by tide level. Stratigraphically the channeled tidal-flat complex on northwest Andros Island is transgressive whereas the nonchanneled flats on the southwestern coast are thought to be regressive. —*from* Authors' abstract

Shirokova, I. *See* Linchenat, A. 05389

05457 **Shklanka, Roman.** Copper, nickel, lead and zinc deposits of Ontario: Ontario Dept. Mines Mineral Resources Circ. 12, 394 p., illus., table, 1969.

In this fifth inventory report on copper, nickel, lead and zinc resources of Ontario, more than 166 deposits are classified and briefly described; economic aspects are emphasized, and known development work undertaken and sources of information are included. In 1967, 65 percent of Ontario's total mineral production came from mines producing copper, nickel, lead, or zinc. Two types of ores, nickel-copper and copper-lead-zinc, account for more than 95 percent of this production; they are derived mainly from two geological types — Ni-Cu deposits associated with mafic and ultramafic rocks and conformable Cu-Zn deposits. A more than doubling of the value in the past twelve years of copper, nickel, lead and zinc produced, corresponding to marked increases in quantity of copper, lead and zinc produced and a slight increase in nickel production, indicate continued success of exploration efforts expended. — *from* Author's abstract

Showalter, D. L. *See* Morgan, J. W. 05487

Sigler, James P. *See* Kesling, Robert V. 05482

05581 **Silberling, N. J.; Reeves, R. G. (leaders).** [Mesozoic sediments and structures; Nevada iron ores] *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 14/1-14/17, illus., 1969.

This is a road log for a one-day field trip of 163 miles and includes brief descriptions of eleven stops and two optional ones. Pre-Tertiary geology of the region is described in an introduction, and several iron-ore deposits are visited. — HRC

05520 **Silver, Eli A.** Late Cenozoic underthrusting of the continental margin off northernmost California: Science, v. 166, no. 3910, p. 1265-1266, illus., 1969.

The presence of magnetic anomaly 3, age 5 m.y., beneath the continental slope off northernmost California, is evidence for underthrusting of the continental margin during the late Cenozoic. Folded and faulted strata near the base of the slope attest to deformation of the eastern edge of the turbidite sediments in the Gorda Basin; the deformation observed is exactly that expected from underthrusting. The relative motions of three crustal plates also suggest underthrusting, possibly with a major component of right-lateral slip. — Author's abstract

Simmons, Gene. *See* Horai, Ki-iti. 05090

Simmons, Gene. *See* Horai, Ki-iti. 05103

05263 **Sinclair, A. J.; Percy, G. R.** Multiple regression analysis of precious metal values, Phoenix mine, British Columbia: Econ. Geology, v. 64, no. 7, p. 822-824, tables, 1969.

Multiple regression analysis of assay data for 220 samples from the Phoenix mine, Boundary district, British Columbia, points to a correlation of high gold and silver values with high chalcopyrite and pyrite content of the ore. In addition, a negative correlation between gold and lime-bearing minerals was found. These results have a direct practical application to visual, precious-metal grade control during mining operations. — Authors' abstract

05407 **Singh, Awtar; Mitchell, James K.** General stress-strain-time function for soils — Closure [to discussion of paper 5728, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM6, p. 1526-1527, 1969.

The writers of paper 5728 (ibid., v. 94, no. SM1, p. 21-46, 1968) agree with Barden and Poskitt (ibid., v. 95, no. SM1, p. 406-409, 1969) that effective stress ratio, R, may replace the deviator stress for Fig. 27, as implied in Eq. 9. Data are now available for creep times up to 20,000 min; the writers' proposed function still appears valid. Behavior shown by Barden and Poskitt is difficult to interpret; a rheological model is being investigated. The seat of resistance to deformation in soils is in interparticle contacts that are solid-to-solid. As L. K. Walker points out (ibid., v. 95, no. SM1, p. 409-415), parameters A,α and m are likely to be functions of testing conditions, but m may differ in the secondary compressive range. — GDC

Singh, Awtar. *See* Mitchell, James K. 05431

05453 **Singh, Jogeshwar P.** Sand liquefaction under cyclic loading simple shear conditions — Discussion [of paper 5957 by William H. Peacock and H. Bolton Seed, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM4, p. 1118-1119, illus., 1969.

Results presented in the original paper (ibid., v. 94, no. SM3, p. 689-708, 1968) were obtained under conditions more accurately simulating field loading conditions during an earthquake. In comparing them with results of previous cyclic triaxial compression tests, the authors overlooked several important factors. Modification of the results presented is overplotted here to compatible magnitudes of shear strain (15 percent in 10 instead of 100 cycles), making more pronounced the divergence between results of the two types of tests. Loading frequency effects were not considered; nor is shape of loading trace reported for frequencies other than 1 cycle per sec. With pneumatic apparatus, maintainance of a uniform shape is difficult. The authors' comments on possible effects of differing load-trace shapes or experimental data where this has been considered in liquefaction studies would be appreciated. — GDC

05313 **Skinner, R.** Geology of Sioux Lookout map-area, Ontario, a part of the Superior Province of the Precambrian Shield (52J): Canada Geol. Survey Paper 68-45, 10 p., geol. map, 1969.

The map-area is underlain mainly by granitic intrusives and gneisses, enclosing remnant basins of highly folded and faulted greenschist-facies-grade Keewatin and Timiskaming-type eugeosynclinal rocks, including the Savant Group, consisting of three units, and diffuse areas of the English River gneissic belt. The Savant Group has a total thickness of 50,000 feet. Conglomerate of the basal unit contains boulders and pebbles which are described. Migmatites appear to lie in an uplifted fault block, bounded on the southeast by Manitou-Dinorwic zone and on the north by the St. Joseph zone. Keewatin-type greenstones contain gold, base metals, lithium showings, and an iron deposit. — *from* Author's abstract

05126 **Skinner, William Robert.** Geologic evolution of the Beartooth Mountains, Montana and Wyoming—Pt. 8, Ultramafic rocks in the Highline Trail Lakes area, Wyoming [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1205B-1206B, 1969.

Sleeman, J. R. *See* Brewer, R. 05646

05534 **Smith, Bennett L.** The Ompah syncline in relation to the Grenville stratigraphy of eastern Ontario, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 225-228, illus., 1969.

In a small part of the Grenville province 30 to 50 miles northeast of Madoc, Ontario, locally well preserved primary structures permit identification of a stratigraphic sequence in the rocks of the Grenville or Hastings Group within the Ompah syncline. This sequence consists of basal conglomerate overlain by quartzite, thinly laminated schist, marble, and amphibolite. The basal conglomerate rests on steeply folded marble, amphibolite, and quartz-plagioclase gneiss; an angular unconformity is demonstrated by structural discordances and by great contrast in structural style in older and younger rocks. — Author's abstract

05478 **Smith, D. I.** The solutional erosion of limestones in an arctic morphogenetic region, *in* Problems of the karst denudation — Internat. Speleol. Cong., 5th, Stuttgart 1969, Supp.: Československ. Akad. Věd Geog. Ústav Brno Studia Geog. 5, p. 99-109, illus., table, 1969.

The results described here are based upon observations made during the summer of 1964 in northwestern Somerset Island, at a latitude of approximately 74° N. in the Canadian arctic [Northwest Territories]. About 200 water samples, analyzed in the field for their calcium and magnesium content, were collected from a number of differing sites, associated largely with Ordovician to Lower Devonian units, in three major groups from: major rivers draining limestone catchment areas; water drainage from snow banks; and pools where small patches of marsh or sedge meadow were developed. In the extreme arctic climate the overall rate of solutional erosion is very small, due to low precipitation and lack of continuous soil and vegetation. Solution appears to be particularly concentrated at the snow-limestone interface. Concentration of Ca and Mg is markedly lower than in temperate or tropical regions. — GDC

05127 **Smith, Douglas.** Mineralogy and petrology of an olivine diabase sill complex and associated unusually potassic granophyres, Sierra Ancha, central Arizona [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1206B-1207B, 1969.

05495 **Smith, J. V.; Stephenson, D. A.; Howie, R. A.; Hey, M. H.** Relations between cell dimensions, chemical composition, and site preference of orthopyroxene: Mineralog. Mag., v. 37, no. 285, p. 90-114, illus., tables, 1969.

Cell dimensions for thirty natural and two synthetic orthopyroxenes were determined. Linear regression analyses between cell dimensions and Mg, Al, and Ca contents were satisfactory after a term for Mg^2 was added. Earlier measurements of *a* and *b* for plutonic pyroxenes are consistent within possible experimental uncertainties

with those given here; however *a* and *b* data obtained by Kuno and Hess on volcanic rocks are considerably higher. Although there are uncertainties in the Ca content and its effect on *a* and *b*, the larger dimensions probably result from lower site preference. Prediction of Mg, Ca, and Al from just the cell dimensions is only moderately accurate even for metamorphic orthopyroxenes. — *from* Authors' abstract

05414 **Smith, James W.; Green, Martha A.; Pickering, S. M., Jr.; Auvil, Jesse H.; Furlow, James W.** (compilers). Mineral resource map of Georgia: [Atlanta, Ga.] Georgia Dept. Mines, Mining and Geology, scale about 1 in. to 33 mi., text, 1969.

The text summarizes the mineral resources in Georgia, indicating composition, localities, and uses for asbestos, barite, bauxite, coal, copper ores, corundum, dolostone, feldspar, fuller's earth, gold, granite and gneiss, heavy minerals, iron ore, kaolin, kyanite, limestone, manganese ores, marble, muscovite mica, ocher, phosphate, pyrite, quartzite, sand and gravel, sandstone, shale, sillimanite, structural clays, talc and soapstone, vermiculite, and miscellaneous minerals. — MCM

Smith, Joseph V. *See* Smyth, Joseph R. 05493

05523 **Smith, North.** Determining the dynamic properties of snow and ice by forced vibration: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Tech. Rept. 216, 17 p., illus., tables, 1969.

The complex dynamic Young's and shear moduli, loss factor and Poisson's ratio are presented for naturally compacted glacial snow through a density range of 0.4 to 0.9 g/cm^3. A frequency dependence of the moduli and its effect on the computation of Poisson's ratio are demonstrated. Considerable scatter is exhibited in the loss factor measurements; however, indications are that the loss factors have negligible effect on the modulus computations. — Author's abstract

Smith, Raymond J. *See* Hironaka, Melvin C. 05406

05654 **Smith, W. D. M.** Log analysis by analogy: Oilweek, v. 20, no. 34, p. 18-20, 22, 25, illus., table, 1969.

Log-analysis of western Canadian oil and gas reservoirs has made it possible to establish some petrophysical relations for use in the area. Composite log analysis charts are presented that illustrate the degree of oil (gas) zone definition for some of the reservoirs studied; these were constructed using the Archie equation and log resistivity and porosity data. The charts indicate generally good oil (gas) zone definition in sandstones except for some clay bearing sands; very poor oil (gas) zone definition in low porosity limestones, which improves when porosity exceeds about 8 percent; very good zone definition in coarse vugular dolomites; and unpredictable variations in calculated water saturation values in all three rock types. — VSN

05128 **Smith, William Gill.** Sedimentary environments and environmental change in the peat-forming area of south Florida [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1207B, 1969.

05100 **Smyth, J. R.** Orthopyroxene-high-low clinopyroxene inversions: Earth and Planetary Sci. Letters, v. 6, no. 5, p. 406-407, table, 1969.

The high-low clinopyroxene inversion predicted by Smith is confirmed and the inversion is indicated to be displacive, occurring rapidly on quenching. The inversion from orthopyroxene to twinned high clinopyroxene is reconstructive, requiring the breaking of silicon oxygen bonds. —*from* Author's conclusions

05493 **Smyth, Joseph R.; Smith, Joseph V.** Electrostatic energy for ion clustering in intermediate plagioclase feldspar: Mineralog. Mag., v. 37, no. 286, p. 181-184, tables, 1969.

Electrostatic calculations estimated the energy of hypothetical ion clustering in intermediate plagioclase feldspars. The calculated energy appears too great to allow segregation of Ca and Na atoms into domains upon annealing without a corresponding movement of Al and Si from an original disordered structure. The calculated energy may be sufficiently small that Ca and Na atoms can disorder partially without movement of Al and Si upon heating a low-plagioclase to high temperatures. — Authors' summary

05535 **Snow, David T.** Rock fracture spacings, openings, and porosities — Closure [to discussion of paper 5736, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM3, p. 880-883, 1969.

In reply to discussions of paper 5736 (ibid., v. 94, SM1, p. 73-91, 1968), Snow questions the adequacy of correlating grout with porosity rather than permeability; welcomes confirmation of expected depth for fracture openings in foundations, and rational criterion for cement versus chemical grout; and says nonrandom joints invalidate Poisson if their frequency depends on proximity to faults. Pressure tests give evidence of relation between fracture geometry and topography. Depth has been a convenient measure of disturbance, but effective or deviator stress may be more consistently related to fracture permeability, porosity, spacing or aperture. Neglect of turbulence near a drill-hole introduces little error in porosities in hard granitic or metamorphic rocks, but turbulence may arise in solution-enlarged carbonate fractures, joints close to surface, and sheet-joints parallel to abutment slopes or fractures disrupted by slumping. — GDC

Snyder, R. P. *See* Orkild, Paul P. 05383

Soffel, H. C. *See* Ehrlick, M. 05396

05504 **Spector, Allan.** Spectral analysis of aeromagnetic data [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 2, p. 718B, 1969.

Srinivasan, B. *See* Alexander, E. C., Jr. 05067

05275 **Srivastava, Satish K.** Pollen genus *Wodehousea* and its stratigraphic significance in the Edmonton Formation (Maestrichtian), Alberta, Canada: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1307-1311, illus., 1969.

Four species of the pollen genus *Wodehousea* have been recovered from the Edmonton Formation (Maestrichtian) of Alberta, Canada. *Wodehousea* proved to be stratigraphically significant in subdividing the pollen assemblage of the Edmonton Formation, owing to the restricted vertical distribution of its various species. — Author's abstract

05018 **Stahnke, Clyde Raymond.** The genesis of a chrono-climo-sequence of mollisols in west-central Oklahoma [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 938B-939B, 1969.

05175 **Stauder, William; Nuttli, Otto.** Seismic studies—South central Illinois earthquake of 9 November 1968 [abs.]: Earthquake Notes, v. 40, no. 2, p. 14, 1969.

Stchouzkoy, T. *See* Muxart, R. 05463

Stephenson, D. A. *See* Smith, J. V. 05495

05332 **Stetson, T. R.; Uchupi, Elazar; Milliman, J. D.** Surface and subsurface morphology of two small areas of Blake Plateau [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2045, 1969.

Stevens, James B. *See* Stevens, Margaret S. 05667

05667 **Stevens, Margaret S.; Stevens, James B.; Dawson, Mary R.** New early Miocene formation and vertebrate local fauna, Big Bend National Park, Brewster County, Texas: Texas Memorial Mus. Pearce-Sellards Ser., no. 15, 53 p., illus., tables, 1969.

The early Miocene Delaho (new) Formation is a locally derived sequence of basin fill sediments now severely deformed by later Tertiary normal faulting. These sediments contain the Castolon local fauna comprising seventeen mammalian taxa. Three genera [and type species] are new: [*Moschoedestes delahoensis*, *Priscocamelus wilsoni*, *Delahomeryx browni* — rhinoceratid, camelid, and nothokemadid(?), respectively. A new merycoidodontid species and a new leporid species are also described.] Age of the Castolon local fauna is considered middle Arikareean, and differences between it and other Arikareean faunas are caused in part by ecological bias. — Authors' abstract

05650 **Stevenson, F. J.** Pedohumus — Accumulation and diagenesis during the Quaternary: Soil Sci., v. 107, no. 6, p. 470-479, illus., 1969.

This paper deals primarily with the paleohumus of soils which were formed during interglacial and interstadial stages of the Quaternary. Emphasis is given those paleosols developed on the land surfaces of the upper Mississippi Valley. — JWH

Stewart, Wilson N. *See* Ramanujam, C. G. K. 05517

Stiglich, J. J., Jr. *See* Gazzara, C. P. 05269

05055 **Stingelin, Ronald W.** Operational airborne thermal imaging surveys: Geophysics, v. 34, no. 5, p. 760-771, illus., tables, 1969.

This paper reviews the methodology and significant parameters required in the conduct of airborne infrared imaging surveys using optical-mechanical line scanning systems in the 3 to 5 and 8 to 14 micron spectral regions. Flight-line orientations, types of detectors, nighttime data collection, and amplification circuitry are discussed. —GV

Stoiser, Lee R. *See* Wells, John D. 05301

05293 **Stow, S. H.** The occurrence of arsenic and the color-causing components in Florida land-pebble phosphate rock: Econ. Geology, v. 64, no. 6, p. 667-671, illus., 1969.

Arsenic correlates inversely with phosphorus and directly with iron oxide. Iron oxide is the concentrating agent for arsenic in brown, buff, and white pebbles, and organic carbon with iron minerals other than oxides cause arsenic enrichment in black and gray pebbles. —WSW

Streitz, R. *See* Morton, D. M. 05390

05020 **Strimple, Harrell L.; McGinnis, Michael R.** Fossil crinoid studies—Pt. 5, New crinoid from the Gilmore City Formation, Lower Mississippian of Iowa: Kansas Univ. Paleont. Contr.—Paper 42, p. 21-22, illus., 1969.

A new Lower Mississippian pachylocrinid [*Sostronocrinus superbus*] with cone-shaped dorsal cup and impressed plate angles is described. Arms commonly branch twice. They are composed of uniserial pinnule-bearing brachials. A very long reflexed anal tube has thin small polygonal plates with lateral slits. —Authors' abstract

05061 **Strimple, Harrell L.; Priest, Amel.** Fossil crinoid studies—Pt. 6, New erisocrinid from Nebraska: Kansas Univ. Paleont. Contr.—Paper 42, p. 23-26, illus., 1969.

Description of *Tholiacrinus decapodos* Strimple and Priest, n.sp., from the Oread Formation of eastern Nebraska discloses strategically placed nodes. We advance the idea of a decapod being formed by "elbow-like" knobs at midlength of the arms. The supposition is that the habitat of the animal was the ocean floor rather than being projected above the floor at top of a long stem. —Authors' abstract

05062 **Strimple, Harrell L.** Fossil crinoid studies—Pt. 1, New lecanocrinid from Pennsylvanian of Oklahoma: Kansas Univ. Paleont. Contr.—Paper 42, p. 1-5, illus., 1969.

A new lecanocrinid from Oklahoma of early Missourian (Late Pennsylvanian) age is referred to the genus *Cibolocrinus* Weller. It is one of the largest lecanocrinids known and represents a divergent group in which the dorsal cup has a basal concavity. Discussion of *Tribrachiocrinus* M'Coy and possible affinities is given, leading to the conclusion that this genus belongs to the Inadunata rather than the Flexibilia. —Author's abstract

05064 **Strimple, Harrell L.** Fossil crinoid studies—Pt. 2, Upper Pennsylvanian anobasicrinid from New Mexico: Kansas Univ. Paleont. Contr.—Paper 42, p. 8-10, illus., 1969.

A crinoid crown from Upper Pennsylvanian deposits in New Mexico is identified by coglike contacts of radials and infrabasals of its dorsal cup as belonging to the genus *Schistocrinus* and is similar enough to the type species to be designated as *S.* sp. aff. *S. torquatus*. Relationships of this crinoid to *Anobasicrinus* and *Synphocrinus* are considered. —Author's abstract

05065 **Strimple, Harrell L.** Fossil crinoid studies—Pt. 3, Pennsylvanian crinoids from Ohio and Oklahoma: Kansas Univ. Paleont. Contr.—Paper 42, p. 11-17, illus., 1969.

A resurvey of crinoids from Carbon Hill in Hocking County, Ohio, resulted in discovery of a new species of *Graffhamicrinus* in addition to formerly known species, *G. somersi*, and *Plaxocrinus mooresi*. The crinoids are reported to occur in the McArthur Member of the Pottsville Formation and appear to be of early Desmoinesian or late Atokan age. *P. mooresi* is rather closely related to *P. dornickensis*. A unique morphologic feature is bulged shape of the first primibrachs in such manner as to provide a stop against the outer surface of adjoining radial plates when arms were extended. Spinose axillaries of the arms, together with spinose terminating plates at summit of the anal sac, produced a formidable array of spines when arms were closed. Formational rank of Pumpkin Creek Limestone of southern Oklahoma is recommended. —*from* Author's abstract

05066 **Strimple, Harrell L.; Levorson, C. O.** Fossil crinoid studies—Pt. 4, Two Upper Devonian crinoids: Kansas Univ. Paleont. Contr.—Paper 42, p. 17-20, illus., 1969.

Crinoids from the Shellrock Formation (Upper Devonian) near Mason City in central northern Iowa which Belanski (1928) named *Bactrocrinus westoni* and *Nassoviocrinus goldringae* are redescribed on the basis of new finds. The first, designated as the type of a new genus dedicated to Belanski, is characterized by extremely tall slender basals, the peculiarity of having a variable number of small extra plates intercalated between the basal and radial circlets, very long pinnulate arms, and unusually elongate, narrowly cylindrical anal sac. Arm structure and nature of anal plates support transfer of Belanski's second species from *Nassoviocrinus* to *Quantoxocrinus*. —Authors' abstract

Stumpf, H. T. *See* Rhoades, J. D. 05282

Sturm, R. G. *See* Kaarsberg, Ernest A. 05178

Sun, S. *See* Ehrlick, M. 05396

05333 **Supko, Peter R.** Diagenetic patterns in subsurface Bahaman rocks, San Salvador Island [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2045, 1969.

Sutton, George H. *See* Walker, Daniel A. 05197

Sweet, William E., Jr. *See* Bouma, Arnold H. 05350

05392 **Swift, Donald J. P.** The Black Creek-Peedee boundary in South Carolina — A discussion [reply to remarks by P. H. Benson, "Evidence against a large scale disconformity between the Upper Cretaceous Black Creek and Peedee Formations in South Carolina" 1969]: South Carolina Div. Geology Geol. Notes, v. 13, no. 3, p. 83-84, 1969.

In referring to Swift's 1966 note (ibid., v. 10, no. 1, p. 17-36), Benson (ibid., v. 13, no. 2, p. 47-50) has misinterpreted the reevaluation of Stephenson's (1923) conclusion that *Exogyra cancellata* is missing in the Pee Dee River valley. This was suggested simply because the namesake form was absent at critical outcrops. It is risky to assign time values to a rock unit on the basis of a fossil that is not there. But, if the subzone is really absent, there are better explanations for it than large-scale erosion. Benson takes a clayey silt lithology below the Black Creek Formation at Burches Ferry as evidence of interfingering of the Black Creek and Peedee units. The boundary is marked by small-scale erosion, and this Ostrea bearing silt is rare in the Peedee. It seems simpler to interpret it as a back-barrier lagoonal deposit assigned to the Black Creek. — GDC

05642 **Swift, Donald J. P.; Heron, S. Duncan, Jr.** Stratigraphy of the Carolina Cretaceous: Southeastern Geology, v. 10, no. 4, p. 201-245, illus., 1969.

The Cretaceous is readily divisible into the basal Tuscaloosa, overlying Black Creek Formation, and uppermost Peedee Formation. A contact within the Tuscaloosa shows a basal estuarine unit, the Cape Fear Formation, and an upper fluvial portion, the Middendorf Formation. The Middendorf, Black Creek, and Peedee are time-transgressive Upper Cretaceous facies. The Middendorf-Black Creek contact is interfingering; the Peedee overlies the Black Creek disconformably. The name Lumbee Group is proposed for these units. The Cretaceous-Tertiary boundary is, in outcrop, a disconformity also. The Paleocene Beaufort Formation overlies the Peedee in the proximal subsurface, and logs suggest that the Peedee rests upon marine beds of Austin age or older, the Black Creek and Middendorf being absent. — *from* Authors' abstract

05644 **Syers, J. K.; Jackson, M. L.; Berkheiser, V. E.; Clayton, R. N.; Rex, R. W.** Eolian sediment influence on pedogenesis during the Quaternary: Soil Sci., v. 107, no. 6, p. 421-427, illus., tables, 1969.

Accretions of loess and aerosolic dust into soils can readily be shown through the oxygen isotopic composition of soil quartz. Two northern hemisphere aerosolic dust systems include African dust transported by the Trade Winds and Asian dust transported by the westerly jet streams. The aerosolic dust contains vermiculite which reacts with Cs^{137+} and other ions produced by nuclear explosions. — JWH

05402 **Sykes, C. Ronald.** Mineral resources summary of the Jacks Creek quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 3 p., 1969.

The only mined resource in the Jacks Creek quadrangle is sand which is abundant in the generally unconsolidated sediments; most sand is iron stained which lessens its value. A potential resource is heavy minerals in fluvial deposits and in the Clayton and McNairy Formations. This text accompanies Tennessee Div. Geology Geol. Map GM 12A-NE, by D. L. Brown (cited separately). —MCM

05260 **Sykes, Ronald.** Geologic map of the Doyle quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 327-SE, scale 1:24,000, separate text, 1969.

Mined mineral resources in the Doyle quadrangle are limestone for most general uses from the Monteagle, St. Louis, and Bangor Limestones, and the Warsaw Formation; and dimension sandstone from the Hartselle Formation. Potential resources are shale and chert. — MCM

05439 **Takasaki, K. J.; Valenciano, Santos.** Water in the Kahuku area, Oahu, Hawaii: U.S. Geol. Survey Water-Supply Paper 1874, 59 p., illus., tables, 1969.

The Kakuku area, at the north end of Koolau Range, has the shape of the original volcanic dome. Outcrops are mostly permeable lava flows of the Koolau Volcanic Series, cut by nearly parallel dikes in the remnant fissure zone along the crest. The less permeable dikes impound ground water, at an altitude of 1,000 feet near south end of the area; leakage fluctuates, as flow into intersecting streams or as underflow to basal aquifers on either flank. Basal water is artesian beneath the windward coastal plain; leeward of the dike zone it occurs only under water-table conditions. Quality of the

dike water is excellent except near the north end where contaminated by irrigation water. In the subarea, where pumpage is greatest, sea-water intrusion is a major concern. Most streamflow in low reaches is intermittent and infiltrates into ground water. — GDC

05213 **Tanji, Kenneth K.** Solubility of gypsum in aqueous electrolytes as affected by ion association and ionic strengths up to 0.15*M* and at 25°C: Environmental Sci. and Technology, v. 3, no. 7, p. 656-661, illus., tables, 1969.

A computer program is utilized to calculate ion association and solubility of gypsum in aqueous electrolyte systems of limited ionic strength and at 25°C. The Fortran program accepts nonequilibrium input solute concentrations and considers simultaneously the Debye-Huckel theory, K_{sp} of gypsum and K_D of $CaSO_4$, $MgSO_4$, and $NaSO_4^-$ to predict equilibrium concentrations without prior measurement in the equilibrium state. Predicted cationic activities and stoichiometric solubility of gypsum are in general agreement with observed values in this and other studies. This computer approach provides a comprehensive description of various solution parameters heretofore not fully realized for the above systems. —Author's abstract

Taylor, H. F. W. *See* Edge, R. A. 05076

Taylor, Hugh P., Jr. *See* Sheppard, Simon M. F. 05257

05506 **Taylor, Thomas N.; Eggert, Donald A.** On the structure and relationships of a new Pennsylvanian species of the seed *Pachytesta*: Palaeontology, v. 12, pt. 3, p. 382-387, illus., 1969.

Pachytesta berryvillensis sp. nov., a small trigonocarpalean seed most closely resembling *P. pusilla*, is described and figured from petrifaction material of Upper Pennsylvanian age collected from southeastern Illinois. — Authors' abstract

Tedrick, P. A. *See* Griffin, G. M. 05366

05272 **Tertian, R.** A rapid and accurate X-ray determination of the rare earths elements in solid or liquid materials using the double dilution method, *in* Advances in X-ray analysis, V. 12 — Applications of X-ray Analysis, 17th Ann. Conf., Denver, Colo., 1968, Proc.: New York, Plenum Press, p. 546-562, illus., tables, 1969.

The double dilution method makes it possible to control or calculate the matrix factor, and furnishes corrected intensities proportional to concentration of the element. Results are exact, whatever the composition of the sample, accuracy depending only on quality of measurement and preparation; the method does not require systematic calibration. The procedure has been tested successfully for accurate determination of rare-earth elements using the borax fusion technique, by which all rare-earth elements can be titrated. The concentration range considered for solids is between 0.5 and 100 percent, and with lesser accuracy, between 0.1 and 0.5 percent. Examples are given of analyses of various ores. This method applies to analysis of every solid, especially ores, provided they can be converted to solid or liquid solutions. —*from* Author's abstract

05433 **Thiers, Gerald R.; Seed, H. Bolton.** Cyclic stress-strain characteristics of clay — Closure [to discussion of paper 5871, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM6, p. 1547-1549, illus., 1969.

Sherif has pointed out the contrast (ibid., v. 95, no. SM3, p. 898, 1969) between the minor effect which cyclic loading at small strain levels has on static strength and the more important effect which the same loading has on dynamic moduli. Procedures used in the original paper (ibid., v. 94, no. SM2, p. 555-569, 1968) to determine strength are explained here. Static strength was defined as the peak stress when strain was increased at a constant rate regardless of the strain necessary to cause the stress-strain curve to "peak"; strength values reported are thus independent of strain. If a definition involving strain was used, strength values would have been different. Results were obtained on one soil only and at one frequency level; subsequent tests

on other soils have indicated the same trends, but actual effects of cyclic loading to a strain of given magnitude were found to depend on brittleness of the soil. — GDC

Thomas, G. W. *See* Kissel, D. E. 05666

05287 **Thompson, C. J.** On-line activation analysis with a PDP-9 computer, *in* Modern trends in activation analysis, V. 2 — Internat. Conf., Gaithersburg, Md., 1968, Proc.: U.S. Natl. Bur. Standards Spec. Pub. 312, v. 2, p. 1121-1126, illus., tables, 1969.

An activation analysis system is described which uses an antimony beryllium thermal neutron source, a PDP-9 computer to acquire and analyze spectra, and a fast pneumatic sample changing system. The system is designed for routine quantitative measurements of a few elements in many samples on a continuous basis, and for rapidly analyzing complex spectra to find elements in unknown samples. Computer hardware and software are described. — VSN

Thompson, D. J. *See* Levin, H. L. 05450

Thompson, S. O. *See* McCorkell, R. H. 05050

05466 **Thompson, Thomas L.; Goebel, Edwin D.** Conodonts and stratigraphy of the Meramecian Stage (Upper Mississippian) in Kansas: Kansas Geol. Survey Bull. 192, 56 p., illus., tables, 1968 [1969].

The Warsaw, Salem, St. Louis, and Ste. Genevieve Formations in Kansas, all subsurface, are correlated with the type section in the Mississippi River valley by their conodont fauna. Total thickness exceeds 850 feet, but formations thin to zero at erosional edges beneath the Pennsylvanian unconformity. Lithologic determinations are based on 15 well cores, augmented by acetate peels, thin sections, insoluble residues, and well cuttings. Biogenic carbonate rocks predominate; rocks are altered locally by diagenesis. The restricted outcrops in southeastern Kansas are of late Osagian age, not Meramecian. An abundant Meramecian conodont fauna, over 1,500 specimens recovered as insoluble residues, includes 40 named species, nine doubtful or unnamed species, and two possible new species assigned to 14 genera, and one specimen representing a possible new genus. — *from* Authors' abstract

05057 **Thomson, Ker C.; Ahrens, Thomas J.; Toksöz, M. Nafi.** Dynamic photoelastic studies of P and S wave propagation in prestressed media: Geophysics, v. 34, no. 5, p. 696-712, illus., 1969.

The occasional existence of very pronounced, anomalous, horizontally polarized seismic waves from underground nuclear bomb blasts has been reported by several investigators. In order to further understand this phenomenon and processes of mechanical radiation from explosions, an experimental apparatus has been developed which permits generation and propagation of body waves from explosions in transparent plate models prestressed to various two-dimensional stress configurations. The following predicted results were observed: a pi/4 discontinuity between P and S wave isoclinics for the unstressed case; a tendency for the isoclinics to broaden and envelope the isochromatics in regions where the P and S waves are superimposed; development of serrations in the dynamic isoclinics in the presence of a prestressed field; and finally, a general similarity between the dynamic optical effects in media under tensile and shear prestress. —GV

Tianco, Estrella M. *See* Ponnamperuma, F. N. 05659

05189 **Tocher, Don; Nason, Robert.** Fault creep at Vineyard, California, 1959 to 1969 [abs.]: Earthquake Notes, v. 40, no. 2, p. 23, 1969.

Toksöz, M. Nafi. *See* Thomson, Ker C. 05057

05500 **Totten, S. M.; Moran, S. R.; Gross, D. L.** Greatly altered drift near Youngstown, Ohio: Ohio Jour. Sci., v. 69, no. 4, p. 213-225, illus., 1969.

Greatly altered drift is exposed beneath early Wisconsin (Altonian) Titusville Till in three separate but related buried valleys in two strip mines six miles apart near Youngstown, Ohio. The deeply weathered drift, with a maximum thickness of 33 feet, consists of three till units separated by sand, gravel, and silt. The silt contains organic matter beyond the limit of C-14 dating. The altered drift is greenish gray and noncalcareous. Pebbles in the drift are thoroughly rotted, easily crushed between the fingers, and commonly unidentifiable. A few crystalline pebbles are evidence for the glacial origin of the material. The lower units appear to be more intensely weathered than the upper ones, indicating that more than one period of weathering may be represented. These deeply weathered deposits are probably pre-Wisconsin in age, but no specific age is assigned to them. — Authors' abstract

Trauger, F. D. *See* Koopman, F. C. 05168

05091 **Turekian, Karl K.; Clark, Sydney P., Jr.** Inhomogeneous accumulation of the Earth from the primitive solar nebula: Earth and Planetary Sci. Letters, v. 6, no. 5, p. 346-348, 1969.

Starting at temperatures greater than 2,000°K the primitive solar nebula cools to its present temperature in less than 10^5 years. During cooling, elements and compounds condense in order of increasing vapor pressure. The condensation order is Fe and Ni, Mg, Mg and Fe silicates, alkali silicates, metals such as Ag, Ga, Cu, etc., Fe sulfide, and finally metals such as Hg, Tl, Pb, In, and Bi. Organic compounds and rare gasses would also condense late. When the temperature is below 400°K, conditions change from reducing to oxidizing. The Fe body that is now the Earth's core formed by accumulation of the condensed Fe-Ni in the vicinity of its orbit. It then served as the nucleus upon which the other material deposited which in turn served as a shield to protect the core from later reaction with H_2S and H_2O. Thus, the bulk composition of the Earth may not correspond to any particular type of meteorite class. —HRC

Tyrrell, M. E. *See* Hollenbeck, R. P. 05637

Uchupi, Elazar. *See* Stetson, T. R. 05332

05486 **Ulrych, T. J.** Lead isotopes, lunar capture and mantle evolution: Nature, v. 224, no. 5221, p. 766-768, illus., tables, 1969.

Lead isotope data from young mantle-derived volcanics suggest that the mantle is a two-stage system. The second stage was formed at the time of the global Anorthosite Event, and both events may have been caused by the capture of the Moon by the Earth. — Author's abstract

05428 **Underwood, Lloyd B.** Classification and identification of shales — Closure [to discussion of paper 5560, 1967]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM5, p. 1259-1260, 1969.

Agreeing with Philbrick (ibid., v. 95, no. SM1, p. 348-349, 1969), Table 1 in paper 5560 (ibid., v. 93, no. SM6, p. 97-116, 1967) should include under column 1 a subhead "Measured slope angles" and compare in columns 2 and 3 their average range of values with those of slope heights for both the favorable and unfavorable case. Caution is needed before basing on grain size any assumption as to behavior of shale. In silty shales, silty particles apparently consist mainly of clay minerals which break down like clay shale during shear testing and in preparation for Atterberg tests. The term "soil-like" is believed to be more definitive than "subshale". In profiling moisture depth, samples should first be taken at not more than 2-in intervals, and according to the late Robert Peterson (personal communication), zones of high moisture need critical examination for Atterberg Limits and both peak and residual shear strength. — GDC

05658 **U.S. Bureau of Mines.** Pozzolanic raw materials resources in the central and western United States: U.S. Bur. Mines Inf. Circ. 8421, 117 p., illus., tables, 1969.

Five hundred and thirty-eight samples of pozzolanic raw materials from the central and western United States were evaluated by petrographic methods. About 200 of these were further evaluated by physical tests of their suitability as a pozzolan. Natural pozzolan materials are common in the area but must compete economically with an ever increasing supply of an industrial waste product, fly ash. — CSB

05250 **U.S. Geological Survey.** Aeromagnetic map of the northern Mother Lode area, California: U.S. Geol. Survey Geophys. Inv. Map GP-671, scale 1:62,500, 1969.

05421 **U.S. Geological Survey.** Aeromagnetic map of the Kingston, Kellogg, and part of the Fernwood quadrangles, Shoshone, Benewah and Kootenai Counties, Idaho: U.S. Geol. Survey Geophys. Inv. Map GP-688, scale 1:62,500, 1969.

Ushakov, S. A. *See* Grachev, A. F. 05640

Usik, Lily. *See* Fortescue, J. A. C. 05153

Usik, Lily. *See* Fortescue, J. A. C. 05160

Valenciano, Santos. *See* Takasaki, K. J. 05439

05468 **VanSchmus, W. R.** The mineralogy and petrology of chondritic meteorites: Earth-Sci. Rev., v. 5, no. 3, p. 145-184, illus., tables, 1969.

Chondritic meteorites are naturally divided into five chemical groups according to their chemical compositions. Within each group a range of textures exists which is generally interpreted as representing progressive degrees of recrystallization. In most chondrites, the major minerals are olivine, orthopyroxene, albitic feldspar, troilite, calcic pyroxene, and metallic nickel-iron; the compositions of the silicate minerals are usually uniform within recrystallized chondrites and very similar for individual chondrites belonging to a given group. In unrecrystallized chondrites the minerals are usually quite variable in composition and the primary structures of individual chondrules are well preserved. Most of the chondrite properties can be interpreted in terms of metamorphic equilibration and recrystallization. — *from* Author's summary

VanSickle, G. H. *See* Ward, F. N. 05310

VanWormer, J. D. *See* Major, M. W. 05186

05514 **Vasilescu, Mircea S.** Performance of Muddy Run embankment — Discussion [of paper 6026 by Stanley D. Wilson and David Marano, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM3, p. 919-920, 1969.

Unfavorable and difficult conditions at the dam site on Muddy Run (near Holtwood, Pa.), make that project an outstanding achievement. As to embankment performance described in paper 6026 (ibid., v. 94, SM4, p. 859-881, 1969), it is not clear to this writer to what extent the movement, subsequent to the first filling, shows a tendency of attenuation. It might help to know just when the first filling took place — dates given are not clearly specific, nor what part of the recorded movement is horizontal and what vertical. It would also be well to know to what extent fullness of the reservoir affects the readings, and if any attempt has been made to learn what influence an increase in water content may have on the weathered schist bedrock. — GDC

05537 **Vasilescu, Mircea S.** A model for the mechanics of jointed rock — Discussion [of paper 5937 by Richard E. Goodman, Robert L. Taylor, and Tor L. Brekke, 1968]: Am. Soc. Civil Engineers Proc., v. 95, Jour. Soil Mechanics and Found. Div., no. SM3, p. 899-900, 1969.

Assuming that the rock mass is not a continuum, the authors of paper 5937 (ibid., v. 94, no. SM3, p. 637-659, 1968) developed a method of computing joint systems through unit stiffness along the joint, and across it, and shear strength along the joint,

also possibly off-diagonal stiffness. From their table illustrating effects around a circular tunnel, there are significant differences between tangential stresses computed according to the elastic continuum medium theory and the newly proposed one. This writer is aware of limitations in the continuum medium theory, but cannot agree with the assumption that the authors' new method may lead to a more rational design. It seems doubtful, since rock mechanics is by nature a natural science, that problems of stability in underground openings can be realistically solved by this new method. — GDC

05639 **Vaughn, Peter Paul.** Further evidence of close relationship of the trematopsid and dissorophid labyrinthodont amphibians with a description of a new genus and new species: Southern California Acad. Sci. Bull., v. 68, pt. 3, p. 121-130, illus., 1969.

A new species of a new genus of trematopsid labyrinthodont amphibian, *Ecolsonia cutlerensis*, is described on the basis of a partial skull found in the Lower Permian [Cutler Formation] of northern New Mexico. The basic similarities to other trematopsids, including the presence of the characteristically elongated external narial opening, are clear; but in the nature of the palate — with wide interpterygoid vacuities — *Ecolsonia* shows marked resemblances to the dissorophid labyrinthodonts. This reinforces earlier assessments of close relationship between the trematopsids and dissorophids. — Author's abstract

05394 **Vidale, Rosemary.** Metasomatism in a chemical gradient and the formation of calc-silicate bands: Am. Jour. Sci., v. 267, no. 8, p. 857-874, illus., tables, 1969.

Mineral assemblages with different bulk chemical compositions in the system K_2O-CaO-MgO-Al_2O_3-SiO_2-H_2O-($\pm$ CO_2) were juxtaposed at 600°C and 2000 bars for 14 and 28 days in salt solutions. Two initial geometries were used; both tended to form similar new zonations consisting of sequences of mostly three- and four-mineral phase assemblages. Formation of the new zonations required differential movement of K, Ca, Mg, and probably Al, and the rate of their formation was increased by increased temperature, pore fluids, and higher salt concentrations. Metasomatic transport apparently proceeded almost entirely through the pore fluid. Two zoned calc-silicate bands from kyanite-grade rocks of western Connecticut show compositional variations that strongly suggest differential movement during metamorphism similar to that observed in the experimental study. — *from* Author's abstract

05117 **Viletto, John, Jr.** Channel morphology in northwestern Pennsylvania [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1207B-1208B, 1969.

Vineyard, Jerry D. *See* Hayes, William C. 05072

05073 **Vineyard, Jerry D.** Bibliography of the geology of Missouri, 1968: Missouri Geol. Survey and Water Resources Inf. Circ. 21, 48 p., 1969.

05105 **Visher, Glenn S.** Grain-size distributions and depositional processes: Jour. Sed. Petrology, v. 39, no. 3, p. 1074-1106, illus., table, 1969.

Analysis is based on recognition of subpopulations within lognormal grain size distributions. Lognormal subpopulations may be related to different modes of sediment transport and deposition. Transport modes reflected are: suspension, saltation, and surface creep. The number, amount, size-range, mixing, and sorting of populations vary with provenance, sedimentary process, and sedimentary dynamics. Some processes are uniquely reflected in log-probability curves of grain size distributions of sands and sandstones, including current, swash and backwash, wave, tidal channel, fallout from suspension, turbidity current, and aeolian dune. Combinations also produce characteristic curves. Plots of ancient sands are directly comparable to those from modern sands. The principal limitation of this study is in comparing sands formed under comparable conditions and obtaining an independent determination of the processes of formation of ancient sands. —*from* Author's abstract

05440 **Voegeli, Paul T., Sr.; King, Robert U.** Occurrence and distribution of molybdenum in the surface water of Colorado: U.S. Geol. Survey Water-Supply Paper 1535-N, p. N1-N32, illus., tables, 1969.

Molybdenum was detected in 89 percent of the samples collected from all the principal Colorado streams and their chief tributaries and from a few reservoirs and lakes. Amounts detected ranged from 1 to 3,800 micrograms per liter. The greatest amounts of molybdenum detected were in samples from the Colorado River at and below Kremmling, the Dillon Reservoir, the Blue River below Dillon Dam, the Eagle River, and Tenmile Creek. — Authors' abstract

05614 **Voight, B.** The state of stresses in the upper part of the Earth's Crust — A discussion [of paper by N. Hast, 1967]: Eng. Geology, v. 3, no. 4, p. 335-339, illus., 1969.

Hast [ibid., v. 2, no. 1, p. 5-17, 1967] recently concluded that the results of his stress measurement work confirm the validity of the contraction hypothesis for evolution of the Earth. This conclusion may not be warranted. A critique and discussion of alternatives that involve continental separation and sea-floor spreading are presented in this paper. — Author's abstract

05589 **Volborth, A.** Second day—Geology of the Eldorado and Newberry Ranges, *in* Basin and Range Geology Field Conf., 2d, Reno, Nev., 1969, Guidebook: Reno, Nev., Mackay School of Mines, p. 2/1-2/9, illus., geol. map, 1969.

This is a roadlog for a 236-mile field trip beginning and ending in Las Vegas, Nevada. Eight stops are made, 3 in the Eldorado Mountains, 4 in the Newberry Mountains, and one at Davis dam, on the Colorado River. Brief descriptions of the geology en route as well as at each of the stops are included; outcrops of various igneous, metamorphic, and sedimentary rocks of Precambrian, Jurassic, and Tertiary ages are visited; a little data on the economic geology of the area, and a generalized geological map of the two ranges are included. — HRC

05382 **Waddington, G. W.** Copper in Quebec [also French edition]: Quebec Dept. Nat. Resources Spec. Paper 4, 395 p., table, 1969.

This compilation constitutes an inventory of copper occurrences in Quebec, and serves as a companion to annotated bibliographies of metallic mineralizations. Information is based on material available in 1964; names of some copper minerals as found in early publications and now obsolete have been changed in order to render the descriptions easier to understand. Descriptions of deposits are arranged by township. An appendix lists production and reserve figures. — MCM

05288 **Wakat, M. A.** Catalogue of gamma rays emitted by radionuclides, *in* Modern trends in activation analysis, V. 2 — Internat. Conf., Gaithersburg, Md., 1968, Proc.: U.S. Natl. Bur. Standards Spec. Pub. 312, v. 2, p. 1144-1147, tables, 1969.

A catalog that will include all measured gamma rays emitted by radioactive nuclei and new energy information provided by Ge(Li) spectroscopy is being compiled. The format lists energy (Mev), nuclide, abundance, half life, production code, and associated gamma radiations (energy 1 and 2; abundance 1 and 2). To assist in identification of an unknown gamma emitting sample, a listing is given of up to three possible modes of production for each nuclide. Information for each gamma-ray is stored on punched cards and cards are kept together under each nuclide in order of mass rather than energy. Mechanics of tabulation using the IBM 360 computer for list processing are simple enough to permit frequent updating. — VSN

05306 **Waldbaum, D. R.** (editor). A bibliography of the feldspars: Ann Arbor, Mich., University Microfilms, 145 p., 1969.

This bibliography is an attempt to bring together a large part of the very extensive geological, crystallographic, chemical, and ceramic literature on feldspars. The 2,000 references cover books, theses, papers, and abstracts that have dealt exclusively with feldspars as well as more general papers on their geological distribution and physico-chemical relations to other minerals and substances of geological interest. The compilation is essentially an annotated bibliography with references listed by author, and then chronologically. References are classified into nine categories. Numbers assigned to a given reference will be retained in subsequent revisions of the bibliography. — MCM

05277 **Waldman, M.** *Ichthyodectes* and *Holcolepis* from the Cretaceous of Lac des Bois, Northwest Territories, Canada: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1316-1319, illus., table, 1969.

A complete skull of *Ichthyodectes ctenodon* (Ichthyodectidae) and scattered remains of small individuals of the same genus together with *Holcolepis* (Elopidae), are recorded in association from Cretaceous sediments on the western shore of Lac des Bois, Northwest Territories. The strata are probably of Albian-Cenomanian age, this being based on the fish evidence. The occurrence of this association in the far north of Canada was previously unknown and provides fresh evidence of freedom of nektonic movement in the Cretaceous Mediterranean-North American seaways. — Author's abstract

05197 **Walker, Daniel A.; Sutton, George H.** Seismic phases recorded at Midway, Wake, and Eniwetok [abs.]: Earthquake Notes, v. 40, no. 2, p. 4-5, 1969.

Wallace, Sandra. *See* Hills, L. V. 05618

05310 **Ward, F. N.; Nakagawa, H. M.; Harms, T. F.; VanSickle, G. H.** Atomic-absorption methods of analysis useful in geochemical exploration: U.S. Geol. Survey Bull. 1289, 45 p., tables, 1969.

Atomic-absorption methods for determining 15 elements in soils and rock are described in sufficient detail for use by nontechnically trained persons. Generally, sample dissolution is accomplished by digestion with hot nitric acid, but for gold and tellurium by different combinations of hydrobromic acid and bromine, and for alkalis and calcium by perchloric, nitric, and hydrofluoric acid mixtures. For mercury, sample dissolution is replaced by application of heat to evolve the element or decompose its compounds. Methods differ in judicious use of solvent extraction to separate elements from possible interferences, to achieve a relatively uniform matrix, and to enrich the element above a threshold concentration amenable to atomic-absorption measurement. Most procedures include short introductory statements of documentation and additional references with comments on common interferences when applied to soils and rocks. — *from* Authors' abstract

05641 **Warnke, Detlef A.** Beach changes at the location of landfall of hurricane Alma: Southeastern Geology, v. 10, no. 4, p. 189-200, illus., tables, 1969.

Several hurricanes have caused considerable beach damage in the Big Bend area of Florida; Betsy, in 1966 was the most destructive. Plane-table surveys have shown the beach loss and clearly showed the retreat of the forward-dune apron, irreversible at the survey site. The differences in damage are due to the presence or absence of surges. Several years of surveying have revealed a continuing beach regression but almost no systematic seasonal beach-profile changes. In view of the significant beach regression at many localities, and the ever increasing population pressure on the coastal areas, continuing detailed studies of the mechanisms and trends of beach changes in the Southeast are needed. — *from* Author's abstract

Warren, D. H. *See* Healy, J. H. 05165

05236 **Warren, Harry V.; Delavault, Robert E.** Aqua regia extractable copper and zinc in volcanic rocks in relation to copper mineralization: Econ. Geology, v. 64, no. 6, p. 672-676, illus., tables, 1969.

The Brenda copper-molybdenum mine near Peachland and the Bethlehem copper mine near Ashcroft have been developed in plutonic rocks from which random collections had shown markedly anomalous amounts of aqua regia extractable copper. The aqua regia extractable copper content of volcanic rocks may likewise be used in assessing the ore possibilities of areas, particularly where there are few outcrops and the geography makes more conventional techniques less applicable. — *from* Authors' abstract

Warren, T. E. *See* Dalziel, I. W. D. 05533

05119 **Washburn, Robert Henry.** Structure and Paleozoic stratigraphy of the Toiyabe Range, southern Lander County, Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1208B, 1969.

Watenpaugh, Frank M. *See* Ramsey, William L. 05388

05092 **Watkins, N. D.; Gunn, B. M.** Magmatic pulsing and charges in titanium concentration during Miocene volcanism in Oregon: Nature, v. 224, no. 5217, p. 360-361, illus., table, 1969.

The time factor involved in trends in chemical data from a lava sequence on Steens Mtn., Oregon, extruded during a Miocene geomagnetic polarity change, is examined. Comparison of paleomagnetic results and chemical analyses provides unique information about the extrusive history and(or) movement of the geomagnetic field. Oldest lavas, paleomagnetic lat.>50°, are succeeded by a group with equatorial latitudes; the higher TiO_2 and lower Al_2O_3 concentrations in the latter are the result of a distinct break in magmatic activity during a finite period of time. Although chemically restricted groups of lavas may have been extruded in relatively rapid succession and can be termed volcanic "pulses", substantial time elapsed during extrusion of some chemically similar lavas. Groups of lavas showing a real decrease of TiO_2 with time are not restricted to a very short time range. —DBV

05334 **Watkins, N. D.** Virtues and vices of paleomagnetic method as applied to marine sedimentary cores [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2045, 1969.

05609 **Watkins, T. H.** (and others). The Grand Colorado — The story of a river and its canyons: [Palo Alto, Calif.] American West Publishing Co., 310 p., illus., 1969.

This book provides a profile of the Colorado River, not so much through topography and geological time as through human time and history; it includes also the continuing controversies between preservation and reclamation interests. The three parts are: (1) the myth — canyon dwellers, many-named river, profitless locality, and into the great unknown (the Powell expedition); (2) the conquest — the desert shall rejoice, making an empire to order, the dam builders, and triumph and failure in the Imperial Valley; and (3) the legacy — pilgrims, poets, and river-runners; conservation and the Colorado; and parklands of the Colorado. Interspersed are five sections of photographs and drawings. The appendix contains an abridged version of Clarence Dutton's *Tertiary history of the Grand Canyon* (1882), titled "The character and geologic history of the Grand Canyon district." — MCM

05660 **Watson, C. L.; McNeal, B. L.; Letey, J.** The effect of surfactants on the hydraulic conductivity of salt-affected soils: Soil Sci., v. 108, no. 1, p. 58-63, illus., tables, 1969.

There is no evidence that water flux through normal soils can be increased by adding nonionic surfactants to the percolating solution. A water-repellent soil responded more favorably, but even then the increase was small and temporary. Although catonic surfactants may maintain the soil structure and water flow in sodic soils where waters low in salts are used, the high concentrations needed with high costs and possible biological effects will limit any field application. — JWH

05278 **Watt, W. Stuart.** The coast-parallel dike swarm of southwest Greenland in relation to the opening of the Labrador Sea: Canadian Jour. Earth Sci., v. 6, no. 5, p. 1320-1321, illus., 1969.

Coast-parallel gabbro dikes in southwest Greenland have been dated as Jurassic; their distribution and age suggest that initial rifting between Greenland and Labrador took place at about the middle of the Mesozoic Era. — Author's abstract

05628 **Watt, W. Stuart.** The Tertiary basalts of Scoresby Sund, a preliminary report: Grönlands Geol. Undersögelse Rap. 21, p. 36-40, illus., 1969.

Basalts up to at least 1820 m thick were investigated; they overlie a southeastward-dipping peneplain and lie on coarse sandstone, probably Mesozoic in age. Individual flows vary considerably in thickness; some are up to 70 m thick. Many flows are separated by characteristic dense, brick-red lateritic horizons ranging on the average from 1 to 5 cm in thickness. A typical flow consists of a lower, light-brown weathering, massive part followed by a thin columnar area in the center of the flow. Above this is again a massive part gradually changing to a black-weathered zone with small highly irregular columns; the uppermost part is vesicular. No pillow lavas are present. Dikes within the basalt are practically unknown, and porphyritic and nonporphyritic lavas are about equally distributed. Correlations are uncertain. — HRC

Wayland, Russell G. *See* Ratté, James C. 05291

05046 **Webb, E. J.** Cambrian exploration in Appalachia, Pts. 1-2: Oil and Gas Jour., v. 67, no. 44, p. 100-101, 1969; Pt. 2, ibid., no. 45, p. 266-268, illus., 1969.

During Cambrian time a thick sedimentary sequence, described in this paper, was deposited in the Appalachian basin. Exploration for oil and gas in this sequence, which attains a thickness of approximately 21,000 feet, should have a great future. Thick shale and sand formations provide source and reservoir beds and faulting contemporaneous with deposition produced structural and stratigraphic traps. —WBC

Webster, R. K. *See* Pierce, T. B. 05286

Wedow, Helmuth, Jr. *See* Hill, William T. 05229

Wedow, Helmuth, Jr. *See* Carpenter, Robert H. 05230

05335 **Weeks, L. A.; Lattimore, R. K.; Harbison, R. N.; Bassinger, B. G.; Merrill, G. F.** Structural relations between Lesser Antilles, Venezuela, and Trinidad-Tobago [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2045-2046, 1969.

05336 **Weidie, A. E.** Tectonics of southern rim of Gulf of Mexico basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 9, p. 2046, 1969.

05301 **Wells, John D.; Stoiser, Lee R.; Elliott, James E.** Geology and geochemistry of the Cortez gold deposit, Nevada: Econ. Geology, v. 64, no. 5, p. 526-537, illus., table, 1969.

Host rocks are thin-bedded dolomitic limestone and siltstone exposed in a window of the Roberts Mountains thrust. "The gold is disseminated in a large zone where the rocks have been fractured and bleached and their pyrite oxidized. . . The alteration zone envelops a 34-m.y.-old intrusive body of biotite-quartz-sanidine porphyry, which is also altered. No genetic relationship between the mineralization and the intrusive body is known. . . The gold is in micron-sized particles. . .mostly with silica between original silt grains and to a lesser extent in" microfractures and pyrite pseudomorphs. A geochemical anomaly led to discovery. —WSW

05599 **Wells, K. L.; Riecken, F. F.** Regional distribution of potassium in the B horizon clay of some prairie loess soils of the midwest: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 582-587, illus., tables, 1969.

Total K content in clay of soils with comparable landscapes and age decreased progressively from west to east along a traverse from eastern Nebraska, across Iowa, and to western Illinois. This was related to average annual precipitation and depth at which clay had accumulated in the profile. Montmorillonite was the dominant clay mineral present in all samples, but illite decreased from west to east as total K content decreased and average annual precipitation increased. Total K content of Iowa samples was also related to amount of sodium tetraphenyl boron (NaTPB) extractable K. — Soil brief

05194 **Wesson, Robert L.** Amplitudes of body phases in a spherically layered earth [abs.]: Earthquake Notes, v. 40, no. 2, p. 3, 1969.

05409 **Westermann, Gerd E. G.** The ammonite fauna of the Kialagvik Formation at Wide Bay, Alaska Peninsula — Pt. 2, *Sonninia sowerbyi* Zone (Bajocian): Bulls. Am. Paleontology, v. 57, no. 255, 226 p., illus., 1969.

The *Sonninia sowerbyi* Zone is represented by the *Eudmetoceras amplectens* assemblage below and the *Pseudocidoceras* assemblage above. Part of the incompetent shales between the two zonules is often missing due to faulting. The underlying *E. howelli* Zone is separated by poorly exposed rocks and the overlying *O. sauzei* Zone is separated by unfossiliferous sandstone and shale. The Ammonoidea are in 15 genera, none new, 13 subgenera with three new, 30 species with 13 to 20 new of which nine are named. About one half of the Ammonitina genera and subgenera range higher than in Europe. Affinities are closest with Europe and secondly to South America; affinities to the western Pacific faunas are weak. — *from* Author's abstract

05395 **Whelan, J. A.** Subsurface brines and soluble salts of subsurface sediments, Sevier Lake, Millard County, Utah: Utah Geol. and Mineralog. Survey Spec. Studies 30, 13 p., illus., tables, 1969.

Brines with slightly under 200 g/l dissolved solids were encountered in three shallow holes drilled on the west side of Sevier Lake in 1966; they contain relatively more sulfate and lithium and relatively less chlorine, magnesium, and bromine than oceanic brines. Calcium and sulfate content increases toward the center of the lake in the N-S direction. Sediments contained an average of about 12 percent soluble salts, but calcium content of the soluble salts is much higher, the sulfate content slightly higher, and sodium, chloride, lithium, and bromine content lower than dissolved salts of coexisting brines. Lithium and bromine content of soluble salts in sediments is negligible. The subsurface brines represent a possible exploitable saline deposit, but additional studies are needed to determine quality and reserves. — *from* Author's abstract

05655 **Whitesides, D. V.; Ryder, Paul D.** Effects of pumping from the Ohio River Valley alluvium between Carrollton and Ghent, Kentucky: Kentucky Geol. Survey ser. 10, Inf. Circ. 18, 20 p., illus., 1969.

Total storage of ground water in the alluvial aquifer in the Carrollton-Ghent area is limited because of the moderate thickness and relatively small areal extent of the aquifer. Recharge from precipitation and subsurface flow from bedrock is not adequate to support the large industrial withdrawals in the area. However, recharge by induced infiltration from the Ohio River has sustained very large yields in other areas. Accurate knowledge of induced-infiltration are critical to the problem of insuring uninterrupted water supplies in this area. Properly located and designed wells and well fields should provide enough water for present and reasonable future demands. — Authors' conclusion

05617 **Wickenden, R. T. D.** An undeformed specimen of the Lower Cretaceous foraminifer *Haplophragmoides gigas* Cushman, from Alberta [with French abs.], *in* Contributions to Canadian paleontology: Canada Geol. Survey Bull. 182, p. 135-137, illus., 1969.

Previous studies of the species have been based on crushed specimens. The present specimen allows a more complete description than was previously possible. *Haplophragmoides gigas* Cushman is an important index fossil in the basal part of the Middle Albian Joli Fou Formation of Alberta, Saskatchewan, and Manitoba. — Author's abstract

05297 **Wignall, Thomas K.** Generalized Bayesian classification functions, K classes: Econ. Geology, v. 64, no. 5, p. 571-574, illus., 1969.

Sample data from streams emanating from known mines in southeastern Pennsylvania were used to formulate, from vectors of trace elements, a set of 8 discriminant functions to classify each location as belonging, with the given probability, to one of eight classes: unmineralized, copper, iron, lead, zinc, chromium, copper and iron, silver, gold. Some locations without known mineralization can be identified as being favorable for exploration. —WSW

Wilding, L. P. *See* Conyers, E. S. 05594

Wilding, L. P. *See* McCormack, D. E. 05600

Wildung, Raymond E. *See* Hajek, Benjamin F. 05043

05027 **Williamson, Iain A.** Discussion of an article by G. B. Asquith entitled "Origin of large kaolinite crystals in the lower Almond Formation of south-west Wyoming" [1968]: Jour. Sed. Petrology, v. 39, no. 3, p. 1255, 1969.

The recognition of Cretaceous tonsteins from Wyoming extends the knowledge of this group of structures and the photograph used in the original (ibid., v. 38, p. 948-949, 1968) is considered a crystal tonstein by Williamson. Other occurrences in North America are cited. —HRC

05259 **Wilson, Charles W., Jr.; Russell, Ernest E.** Geologic map of the Rockport quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 21-NE, scale 1:24,000, separate text, 1969.

The accompanying text, "Mineral resources summary of the Rockport quadrangle, Tennessee," by C. W. Wilson, Jr. is cited separately. — MCM

05403 **Wilson, Charles W., Jr.** Mineral resources summary of the Rockport quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 5 p., 1969.

Mined mineral resources in the Rockport quadrangle are chert for road surfacing from the Camden and Harriman Formations and limestone for most uses from the Decatur Limestone and Rockhouse Limestone Member of the Ross Formation. Potential resources are sand and gravel, and possibly tripoli and silica. This text accompanies Tennessee Div. Geology Geol. Map GM 21-NE by C. W. Wilson, Jr., and E. E. Russell (cited separately). — MCM

Winchell, R. E. *See* Ehrreich, A. L. 05489

05528 **Windley, B. F.** Evolution of the early Precambrian basement complex of southern West Greenland, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 155-161, illus., tables, 1969.

The Precambrian rocks in five regions between Sukkertoppen and Ravns Storö are divided into basement and linear belts. The basement contains many conformable relicts of meta-anorthosite and two extensive chromite-layered complexes, metamorphhosed under granulite facies conditions and folded into large-scale interference patterns; one K-Ar date was 3210 m.y. The linear belts, 10-100 km wide, bounded by shear belts, transect the folded basement; they were formed under synorogenic, amphibolite facies conditions, and contain conformable relict layers of pillow-bearing greenschists and various retrogressed metasediments, with K-Ar ages of 2410-2710 m.y. They affected the neighboring basement by static overprinting which caused retrogression of the acidic gneisses but left the basic rocks with granulite facies mineralogy. — VMJ

05208 **Witkind, Irving J.** Geology of the Tepee Creek quadrangle, Montana-Wyoming: U.S. Geol. Survey Prof. Paper 609, 101 p., illus., tables, geol. map, 1969.

The Tepee Creek quadrangle overlies the meizoseismal area of the Hebgen Lake earthquake of August 17, 1959. Sedimentary units ranging in age from Cambrian to Cretaceous rest on a basement complex of Precambrian crystalline rocks. These units have undergone two major deformational episodes. The first occurred during

the Laramide when lateral compressive forces from the southwest shoved them to the northeast along northwest-trending thrust faults. The second episode, which probably began during the Middle Tertiary and is still active today, may be the result of relaxation following renewed regional arching. As the elevated region subsided it broke along high-angle normal faults to form tilted fault blocks. The reactivation of various of these normal faults resulted in the Hebgen Lake earthquake. —IJW

05311 **Wobber, F. J.** Environmental studies using earth orbital photography: Photogrammetria, v. 24, nos. 3-4, p. 107-165, illus., tables, 1969.

Orbital remote sensing, and particularly orbital photography, can provide immediately useful data. Color, color infrared, and black and white space photographs obtained on the Gemini and Apollo programs provide unique synoptic tools for analyzing modern environments and processes. Principal advantages include repetitious world-wide coverage, and synoptic observations on a scale generally impossible from aircraft. The general categories of environmental data that can be extracted from orbital photography are summarized. Use of supporting sensor records, increased system resolution, and repetitious photographic coverage will maximize data yield. — *from* Author's abstract

Wogman, N. A. *See* Rancitelli, L. A. 05521

05447 **Woldstedt, Paul.** Nordamerika, Chap. 7 *in* Handbuch der stratigraphischen Geologie—V.2, Quartär: Stuttgart, Germany, Ferdinand Enke Verlag, p. 142-158, illus., tables, 1969.

Chapter 7 in this handbook compares the glaciations of North America with Europe, considering the southern boundaries of the four big ice stages, many manifestations of interglacial stages, and the driftless area in the central United States. Fluctuations in deposits related to glacial and pluvial periods are noted from Canada to South Dakota to Texas, in terrace levels and interstratifications. Paleoclimates of 8000 to 32,000 years ago, in the Llano Estacado of Texas-New Mexico and the Great Plains of the upper Mississippi Valley, are correlated with northern Europe. Pluvial lake levels, and terraces of the Mississippi River delta and Atlantic coast are related. Features of the Rocky Mountains are contrasted with ancient Lakes Bonneville and Lahontan, and Searles Lake basin. The North American fauna are listed in three large groups: the Blanca, Irvington, and Rancho La Brea. — GDC

Wood, Albert E. *See* Ferrusquia-Villafranca, Ismael. 05586

Wood, S. O., Jr. *See* Park, W. G. 05243

05484 **Wright, Jean D.** Charles Southworth, fossil collector of Thedford, Ontario, 1880-1968: Michigan Univ. Mus. Paleontology Contr., v. 22, no. 23, p. 323-338, illus., 1969.

Wright, Ramil C. *See* Marszalek, Donald S. 05317

05120 **Wu, Dah Cheng.** Clay mineralogy and geochemistry of the upper Flowerpot Shale in Major and Blaine Counties, Oklahoma [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1208B-1209B, 1969.

05166 **Wu, Francis T.; Allen, Richard.** $dT/d\Delta$ in the range of 30° to 90° [abs.]: Earthquake Notes, v. 40, no. 2, p. 10-11, 1969.

Wyllie, P. J. *See* Boettcher, A. L. 05380

05524 **Wynne-Edwards, H. R.** (editor). Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, 228 p., illus., tables, geol. maps, 1969.

This volume contains most of the papers that were presented in 1967 at an international symposium on the radiometric age relations of structural provinces of the continental Precambrian shields of the world, including Precambrian terranes reworked

as the basements of younger orogenic belts. Of the 22 papers, the 10 pertaining to North America (Canada and Greenland) are cited separately: senior authors are R. J. W. Douglas, G. Henderson, N. Henriksen, B. F. Windley, H. R. Wynne-Edwards, J. Martignole, T. E. Krogh, R. E. Zartman, I. W. D. Dalziel, and B. L. Smith. — VMJ

05529 **Wynne-Edwards, H. R.** Tectonic overprinting in the Grenville province, southwestern Quebec, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 163-182, illus., tables, 1969.

Systematic mapping of Mont Laurier and Kempt Lake map-areas, 13,000 sq mi, has provided structural and textural criteria for dividing plutonic and high-grade metamorphic rocks into five tectonic categories relative to the Grenville orogeny: pretectonic granitic gneiss basement complex; pretectonic metasedimentary Grenville Group; pretectonic plutonic intrusive group; syntectonic plutonic intrusive group; post-tectonic diabase dikes. The structure results from northeast-trending flow folds of the Grenville orogeny (about 950 m.y.) superposed on east-trending structures in the basement complex to the northwest and on north-trending structures to the southeast. There is thus a record of continued tectonic overprinting extending back 2500 m.y. to the Archean, with Kenoran, Hudsonian, Elsonian, and Grenville orogenies each modifying all rocks already present, and contributing 'new' ones. — VMJ

Yelverton, J. N. *See* Gilreath, J. A. 05363

05437 **Yen, Bing C.** Stability of slopes undergoing creep deformation: Am. Soc. Civil Engineers Proc., v. 95, paper 6675, Jour. Soil Mechanics and Found. Div., no. SM4, p. 1075-1096, illus., tables, 1969.

Analysis of a long slope undergoing creep deformation is based on assumptions that the soil flows viscously with no volume change, and that creep deformation ensues when shear stress due to gravity exceeds soil residual shear strength. Expressions to describe the velocity field in the creep zone of the slope are derived. The results, discussed for the cases with or without surcharge loads, are presented in dimensionless charts. Because of assumptions used, theoretical results appear to be applicable to slopes of over-consolidated clay or clay shales. To determine the average coefficient of soil viscosity, field displacement versus time records of the slope undergoing creep are necessary. Two published soil creep case histories [California and Black Sea coasts] verify the theoretical analysis. — *from* ASCE abstract

05110 **Yiu, Shih-Kao.** A measure of the energy flux represented by a seismogram [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 30, no. 3, p. 1212B, 1969.

05476 **York, Derek; Macintyre, R. M.; Gittins, J.** Excess radiogenic ^{40}Ar in cancrinite and sodalite: Earth and Planetary Sci. Letters, v. 7, no. 1, p. 25-28, illus., tables, 1969.

Anomalously high K-Ar ages are found for cancrinite and sodalite. In cancrinite the volume of excess Ar-40 ranges from $2.4\text{-}2.6 \times 10^{-4}$ ccntp/g while smaller excesses, $0.59\text{-}1.5 \times 10^{-5}$ ccntp/g are found in sodalite. One scapolite examined gives an apparently reasonable K-Ar age. — Authors' abstract

05507 **Young, C. Wayne.** Depth prediction for earth-penetrating projectiles: Am. Soc. Civil Engineers Proc., v. 95, paper 6558, Jour. Soil Mechanics and Found. Div., no. SM3, p. 803-817, illus., tables, 1969.

An empirical equation is developed for the prediction of total penetration distance of a projectile in many natural earth targets, based on approximately 160 full-scale penetration tests into a variety of targets, including rock, gypsite, permafrost, ice, desert alluvium, silt, sand and saturated clay. The parameters considered in the development (other than target materials) were projectile weights from 222 to 5,750 lb, projectile diameters from 3.1 to 18 in., impact velocities from 78 to 1,077 fps, and 11 projectile nose shapes. The equation fits 91 percent of the data within 20 percent, and fits 98.5 percent of the data within 25 percent. The necessary tables of nose-performance coefficients and soil constants are presented for practical engineering usage. — *from* ASCE abstract

05255 **Yule, Herbert P.** Computation of experimental results in activation analysis, *in* Modern trends in activation analysis, V. 1 — Internat. Conf., Gaithersburg, Md., 1968, Proc.: U.S. Natl. Bur. Standards Spec. Pub. 312, v. 2, p. 1555-1204, illus., tables, 1969.

The early history of activation analysis is traced to show development of computation methods as new instrumentation has appeared; methods developed prior to 1962, when computers were first applied to calculation, are reviewed in considerable detail. Methods of computation used today are described in separate subsections and include: peak area method, least squares analysis of pulse height spectra, spectrum stripping, smoothing and differentiation of spectra, decay curve analysis, and miscellaneous techniques. The spectrum stripping method has been abandoned for the most part because of the greater accuracy of least squares technique or greater resolution of the Ge(Li) detectors. — VSN

Zakrzyevskaya, I. V. *See* Cherdyntsev, V. V. 05401

05532 **Zartman, Robert E.** Lead isotopes in igneous rocks of the Grenville province as a possible clue to the presence of older crust, *in* Age relations in high-grade metamorphic terrains: Geol. Assoc. Canada Spec. Paper 5, p. 193-205, illus., tables, 1969.

On the basis of lead isotope studies on potassium feldspars from numerous North American igneous rocks about 1 b.y. old, it has been postulated that: lead generated in large batholithic bodies or extensive metamorphic terranes of contemporaneous age will have limited isotopic variations and model ages close to radiometric ages of the samples; but lead in small stocks in or near considerably older basement may have anomalously radiogenic Pb-206:Pb-204 ratios and model ages as old as the basement. A vertically differentiated crustal model is proposed, with necessary physical and chemical characteristics to explain both types of lead. Several samples from the Grenville province of Canada all have radiometric dates of 1 b.y., but lead from igneous bodies near Mount Reed, Quebec, have model ages of about 1.5 b.y., almost as old as the basement of the nearby Labrador trough. — VMJ

05601 **Zaslavsky, Dan; Rogowski, A. S.** Hydrologic and morphologic implications of anisotropy and infiltration in soil profile development: Soil Sci. Soc. America Proc., v. 33, no. 4, p. 594-599, illus., 1969.

The concept of anisotropy as a possible factor of soil formation is introduced and the hydrologic and morphologic implications of water infiltration are demonstrated. It is concluded that the magnitude and direction of downhill flux of infiltrating water will depend on the degree of anisotropy as well as on the land slope and its changes. This conclusion may explain in part the greater differentiation of horizons on flat lands than on sloping lands, and the gradual thinning out of the B horizon uphill as the slope increases. — Authors' abstract

05056 **Zohdy, Adel A. R.** The use of Schlumberger and equatorial soundings in groundwater investigations near El Paso, Texas: Geophysics, v. 34, no. 5, p. 713-728, illus., 1969.

Electrical soundings using the symmetric AMNB Schlumberger and bipole-dipole equatorial arrays were made along two profiles near El Paso, Texas, in a groundwater exploration program. Electrode spacings to 12,000 feet allowed exploration to depths of 7,000 feet. Geoelectrical information on subsurface materials was augmented by sounding with the bilateral equatorial configuration and by transforming Schlumberger curves into dipole-polar sounding curves. The former was useful for detecting direction of dip of highly resistive bedrocks, and the latter to evaluate average longitudinal resistivity and depth to the electric basement. Interpretation of a combined Schlumberger-equatorial sounding curve was confirmed by data from a test well. The application of the method furnished valuable information on depth to fresh-water—salt-water interfaces and on depth to impervious bedrock. —GV

Zupan, Alan-Jon. *See* Bouma,

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